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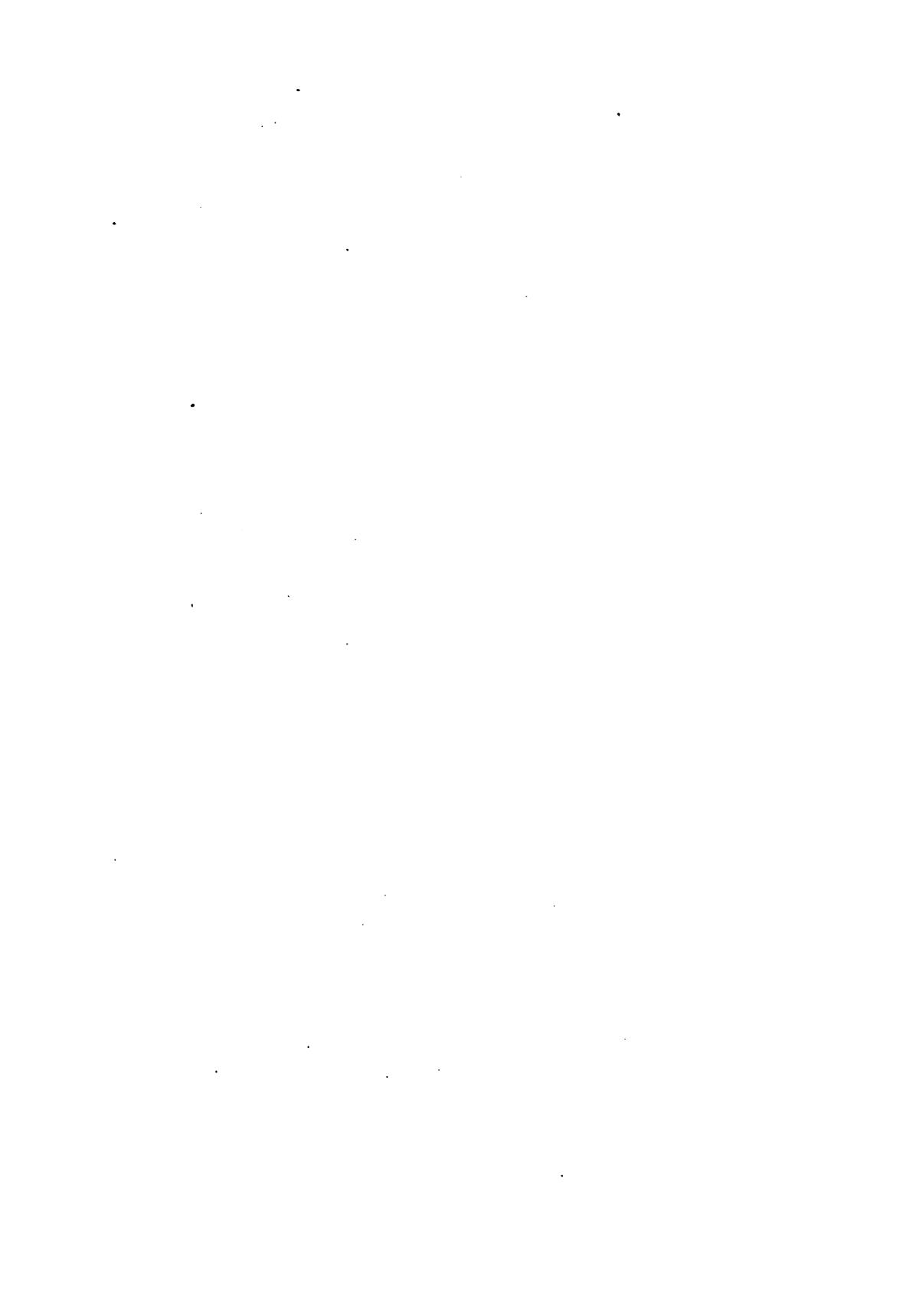
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SEPTIC CONDITIONS

OF THE

INFANTILE ALIMENTARY CANAL, LAINE LIBRARY AND THEIR

TREATMENT.

BY

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PREFACE.

THE great success in treatment, which I have found to follow the lines laid down herein, has emboldened me to publish the results of notes taken from careful attention given to the subject during seven years; and a practical experience of many cases. My thanks are due to all who have, directly or indirectly, contributed any of the materials discussed. This Work assumes a previous acquaintance with the symptomatology and other clinical features of the conditions under consideration, which may be met with in larger treatises; and it is hoped that it may be suggestive of fresh thoughts, even to those who may not be able to endorse all the conclusions arrived at. My sincere thanks are due to Dr. George F. Johnston for his patience and kindness in revising my proofs.

F. W. FORBES ROSS.

63, CHEPSTOW PLACE,

LONDON, W.

TITULAR EXPLANATION.

An attempt to systematise treatment of functional derangement of the Infantile **Alimentary Canal**, due to septic or other causes, by rational combination of bactericidal with other therapeutic methods.

INTRODUCTION.

It will no doubt be easy to gather from the title of this treatise a somewhat clear perception of its object.

When first beginning to experience the realities of medical practice I was conscious of a want of continuity and exactness in treatment, of those affections of the infantile tract, known under the designations of infantile diarrhoea and constipation.

I was led by the difficulties then experienced to conduct certain researches and investigations, which helped me in my work to such a degree that I embodied those results, and my deductions from them in a thesis which I wrote on the subject early in 1893, after four years constant study of the subject.

At that time I devoted my attention to the causes and treatment of the conditions known as "diarrhoea."

Since then I have been led by further investigation and reasoning to include the affection known as "constipation" as coming under the heading of septic conditions of the canal.

With your kind indulgence, I will include in the present treatise certain parts of my earlier work that I have been satisfied by actual practice have not been totally incorrect, along with some further work conducted since that date; on both subjects separately, and taken together, from the septic standpoint.

Although the careful study of the septic conditions of the infantile alimentary canal has rendered many points in the course of the disease more clear and more easy of explanation, as well as more satisfactory as regards successful treatment, we must not fall into the error, so commonly the case with new departures in treatment, of devoting our whole attention to treatment of septic conditions purely and simply, to the exclusion of other and equally useful therapeutic methods belonging to the past decade; remembering that it was the full knowledge of these which, in the light of the enhanced accuracy of information gained, we used as a stepping stone to approach, and a foundation on which to build, the superstructure of the fuller and more rational treatment we now pursue.

The alimentary system being a continuous one, composed of a

series of organs of somewhat analogous functions, it was difficult to see how, since in health they worked in unison, in disease they would not all be affected together, each in accordance with its special functions and structure.

And such is undoubtedly the case, as most of us have found in actual practice. It was only in text books that we found any attempt at separation into divisions and groups of organs, and their so-called special affections.

Seeing that this sub-division is more or less artificial, and that in many cases we are taught to view each special affection in relation to a given branch of treatment, we were prone to fall into the error of attending to these diseases as things apart from one another, to the neglect of the entirety; with the result that some of us from time to time experienced difficulty in attaining success in treatment. Seldom, if ever, has a particular affection of an individual organ existed without intercurrent derangements of organs directly or indirectly connected.

Such being the case, we are constrained to regard the affections of the canal as a whole, and to devise some general line of treatment sufficiently comprehensive in its scope to enable us to successfully deal with the oft concurring complications and various stages of the same affections, so commonly treated in text-books as separate and individual ailments, on one single basis as a whole.

The careful study of septic conditions of the tract, and the existing points of interest and valuable information to be gleaned from the same, taken together with the numerous items of undoubted and proved value in the older methods, produce a combination at once profitable and highly satisfactory. The study of bacteriology of the tract has enabled us to more fully appreciate those minute niceties in symptoms, and to more clearly interpret their indication with a naturally consequent certainty of ultimate success.

The successful treatment of these affections involves primarily a thorough knowledge of those influences generally accepted as being distinctive of that period of life known as infancy and early childhood.

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CHAPTER I.

INFLUENCES PECULIAR TO INFANCY.

THESE influences comprise certain well-known deviations from the adult characteristics, and are :—

I.—*Personal Influences*.—Pertaining to the infant itself.

(a) The markedly dominant influence which the whole Alimentary Tract exerts on the general condition of the infant.

(b) The extreme sensitiveness of the general nervous system to, and the general readiness with which it responds to stimuli conveyed by an ever ready and highly excitable reflex system.

(c) The marked tendency to the reciprocal interchange of reflexes or vicious cycles; their persistence when untreated, yet their ready yielding to suitable treatment.

(d) The ability of the derangement of any section of the canal to produce profound change either above or below that section, and of the functions and secretions of complementary organs, such as the liver, etc.

(e) The cutaneous affections, such as eczema and allied eruptions in cases of constipation, sluggish digestion, and excessive absorption of the products of decomposition taking place within the canal, as also the cutaneous vasomotor reflexes in other derangements.

(f) The influence of intestinal irritation on the cerebral system generally, displayed as lethargy, dullness, heavy or restless sleep, general irritability, progressing even to nerve storms as the laryngeal reflex, convulsions, and disturbances in the balance of the heat and respiratory centres.

(g) Locally in the bowel itself, we note the marked readiness with which the motor mechanism can be excited to action, and the fact that contractions which are usually painless

in the adult are more often than not exquisitely painful and shock-producing, with a strange power to induce general and rapid systemic exhaustion.

(h) The phenomenally powerful influence on the general vasomotor and cardiac systems as shown by the pallor of skin, exhausting perspirations and quickened pulse; as also the local influence on the vessels of the bowel walls and mucosa itself, and the tendency of these reflexes to set up vicious vasomotor cycles.

(i) The liability of the Renal and Hepatic systems to partake in the general vasomotor derangement.

(k) The rapid fall of blood-pressure, which any continued drain of fluid will produce in the absence of a reserve supply; also the influence which such a drain will exert on the maintenance of heat.

(l) The rapidity with which this fall of pressure can be restored by stimulation and suitable treatment. The extreme rapidity with which the strength of an infant can be exhausted and the extraordinary persistence of its reflex irritability, even after total collapse.

(m) The equal rapidity with which a return to health, under favourable circumstances, can be induced.

(n) The peculiar liability an artificially fed infant labours under, in that its sources of sustenance are particularly prone to become contaminated, and thereby act as factors of disease; coupled with the fact that certain of its digestive secretions are almost inert, others feeble in action, and others fitted to deal with only food of particular kind and consistence: all being subject to most profound alteration during ill-health.

II.—*Remote Influences.*

(a) Heredity has more or less influence in determining the stability of the healthy physiological processes of the alimentary canal in an infant, and therapeutics can best be assisted by recognizing the following facts:—

Infants born of parents with marked dyspeptic tendencies

are often subject to digestive trouble. Any derangement of the digestive functions in a pregnant woman should receive prompt attention. A full and suitable diet should be insisted on, as there is no more important branch of infantile therapeutics than that of adequate maternal nutriment during pregnancy, and recognizing the need for maintaining a constant surplus of pabulum in the maternal circulation, in order to enable her to bring forth an individual of normal development and fullest powers to resist the processes of disease.

Further, even taking into consideration specific causation, where it occurs that a woman has previously given birth to infants of feeble constitution, with a tendency to struma, rickets, tuberculosis, etc., or even where an infant or two have succumbed from no other cause than "inanition," whether from the fact that the mother or father, or both, may be in delicate health, or may have an unsatisfactory family history, or as so often happens, where there is an appreciable disparity between the ages of the parents, or from any other probable or possible cause; we may have reason to expect the birth of an enfeebled infant. A great deal more can be accomplished by timely attention on these lines during gestation than after the birth of the child. The above applies equally in the case of a primipara.

When pecuniary and other circumstances permit, it is quite possible, by the "plenum" method of feeding, from the early months of pregnancy right up to the time of birth, to ensure with tolerable certainty, an infant, whose robustness and general constitution will be in marked contrast to previous ones, and a pleasurable surprise to all concerned. Expensive and rich food by no means correlates adequate nutrition for a foetus. This can only be accomplished by attending to the maternal digestion and exhibiting of set purpose, proper foods, proteids, carbohydrates, fats and salts of such a nature as to materially influence a growing foetus, over and above that which an ordinary haphazard diet could accomplish, and ad-

ministered in such suitable proportions and quantities, as would maintain a constant floating surplus on which a developing foetus could draw, and at the same time conserve the highest and best efforts of the maternal digestive powers.

In certain cases, resort to general massage can be had with advantage, by reason of the consequent improvement in the systemic metabolism.

The result of an intelligent trial of these procedures, in even a single instance, will be sufficient to convince as to benefit and desirability.

The intentional special feeding of a prospective mother, multipara or primipara, with a view to the healthiest possible infant, is a department, in the sphere of the family attendant, to which too little direct attention is devoted, and with consequent sad results in many cases.

The above remarks apply even more forcibly to women in affluent circumstances than to their poorer and less fortunate sisters, for many obvious reasons.

(b) Diathesis, such as struma, rickets, syphilis, etc., need only to be mentioned to be borne in mind; though the first two may possibly be brought about by defective digestive processes, and would be directly treated by suitable attention to the alimentary canal.

“Drifting into rickets and struma” of some writers, simply means defective digestion, gastro-intestinal irritation, and excessive septic absorption from the bowel.

(c) Idiosyncrasy, as regards inability to digest certain articles of diet, or a special liability to certain affections under certain conditions, and weaknesses of digestive energy peculiar to the individual, will only occur as a factor to tax the individual skill and originality of the medical attendant, and provide the oft-sought opportunity to shine.

III.—The indirect influences governing the health or disease of an infant are those altogether out of the immediate sphere of the infant, and are:—

(a) General surroundings, as locality, with special relation to soil, sub-soil water, climate, and temperature ; all of which are now too well understood to need further comment.

(b) Sanitation covers a more important field :—Air-space, ventilation, drainage, position and conformity of dwelling-houses and their conveniences, presence or absence of empty or overflowing middens, ash-pits, water-closets, source of water supply, pollution of wells, source of milk supply and treatment of the same before and after it enters the domicile of the infant, and lastly, the presence or absence of general cleanliness as regards both infant and others.

(c) Attendants comprise a group of indirect influences, present in greater or lesser degree in every individual case, and of all others tax the patience, skill, and originality of the physician more sorely than any ; yet are those which receive little or no attention at the hands of infantile gastronomic experts.

These influences possess the following attributes and are of interest :—Ignorance, stupidity, laziness, prejudice, wilful neglect—the opinion of some other practitioner as interpreted by the attendants—and, last but not least, wilfully falsified advertisements of quack patent infants' foods to meet the demands of commerciality.

(d) Poverty is more or less relative, yet must also be taken into account.

CHAPTER II.

POINTS OF POLICY IN PROCEDURE.

FURTHER, one cannot leave this subject without calling the attention of the profession to a factor which is too often neglected in the zeal to furnish patients with the latest and most scientific process of food-preparing, or some other elaborate and intricate process of treatment.

All no doubt most excellent and desirable under certain suitable circumstances and surroundings! Inasmuch as we meet with most of the worst cases and forms of Infantile Alimentary derangement amongst the poorer classes—these more expensive and elaborate methods are worse than useless, being only suited to hospitals with trained staffs, and for the comparatively rich—they cannot or will not be correctly carried out, if at all, to the neglect of some more simple, easy, and less expensive process, which under the circumstances takes precedence as absolutely the most perfect and satisfactory.

Again, the physician who is constantly devoting his attention to sterilization of milk, continuous heating, peptonizing, pancreaticizing, malting, etc., with all the attendant dangers of contamination during and after the processes, if compelled to treat without these aids, becomes terribly handicapped.

It may here be advisable to remind the advocates of rigid sterilization of the natural fondness and proclivity of the infant for dust, dirt and germs, gleamed from every conceivable corner within reach of its fists, which are constantly being sucked.

There is also a growing desire to rush into one solitary branch of treatment, as sterilization of milk solely, prescribing some intestinal

antiseptic drug solely, or some new and difficult method of preparing foods; to the neglect of other equally important matters, leaving the case to recover on that one department in treatment.

This always leaves something to be desired and inevitably brings otherwise valuable methods into marked discredit. If this treatise does nothing but impress these points, its end has been well served.

There is no department of medicine in which attention to the minutest and most trivial details is of greater importance as in that now under consideration.

CHAPTER III.

CLASSIFICATION OF AILMENTS FROM A SEPTIC STANDPOINT.

It seems well that we should now consider Infantile Diarrhoea in relation to its many phases, its causation, and the agents which operate in its maintenance.

It is usual to include under the term Infantile Diarrhoea, so-called Simple Non-Inflammatory Diarrhoea, Acute Inflammatory Diarrhoea and Choleraic Diarrhoea.

The last should more properly be divided into two analogous ailments, one really a far advanced symptom of acute Intestinal Catarrh, and the other a disease, of which the excessive alvine discharge is only a local manifestation, and belongs more properly to diseases of the nervous and vasomotor systems than to Infantile Diarrhoea proper. The condition of the mucosa, brought about by the disease, tends to reduce Cholera Infantum Proper to one of the conditions conducive to excessive septic action. Nevertheless, the disease being one of rapid onset, and equally rapid termination, the septic influences have little or no time in which to play an important part, though, in a recovering case, it is as well to bear in mind the need for watchfulness in order to prevent a true septic process from assailing an already damaged part.

True Cholera Infantum is usually found in those months of the year when temperature ranges high, along with very rapid rises and falls of atmospheric pressure, these rises and falls being somewhat exaggerated in range. An extremely hot day with high pressure, followed by a rapid fall and slight rain; this again followed by an equally rapid and high rise will be almost certain to affect extremely weak infants, by reason of the heat and pressure changes upsetting their nervous stability and disturbing their

balance of blood pressure, as between their cutaneous and portal systems. It is, in fact, a heat stroke.¹

The treatment in main will also be found to differ somewhat from that of the true catarrhs of stomach and bowels, in which the fermentative agencies play a more prominent rôle.

Secondary Cholera Infantum often occurs in the coldest months of the year. It very often is quite as severe in relation to the flow from the bowel wall as the true form, yet is generally preceded by mild or unnoticed inflammatory diarrhoea, is a symptom of intense irritation or excessive exhaustion with profound vasomotor paralysis, and is of the gravest import possible.

It is as well to bear in mind that given a sufficiently intense irritation, say from the products of the putrefactive decomposition of milk curd, a case can be rapidly advanced to the condition of cholera infantum without any appreciable prodromal symptom ; or again, that a case may progress to a rapidly fatal termination, due probably to the largeness of the initial dose of tox-albumin, without any discharge taking place per anum, or before it could be recognized as coming under the term commonly signified by the symptom "diarrhoea," as we commonly know it.

To the list we should add Ulceration of the Bowels as an advanced symptom, complicated often by particular specific germs; true dysentery also, which is generally septic as regards the rest of the canal and particularly septic as regards itself (Streptococcus, Staphylococcus, etc.).

¹ Meinert, Hirsch, and Ballard, attribute this affection to temperature and lack of air currents.

CHAPTER IV.

CONSTIPATION OF INFANTS FROM A SEPTIC POINT OF VIEW
IS DIARRHEA.

MANY cases of gastric catarrh, infantile atrophy, perhaps some cases of tabes mesenterica, enlarged spleen, typhlitis, and constipation in general, so-called idiopathic constipation and post-diarrhoeal constipation are paradoxically diarrhoea. Of the two last, the former is due to, perhaps, special resistant powers of the individual, and to the fact that given a fair gastric digestion and an absence of those irritative agencies particularly known as *bacterium lactis*, *bacterium butyricum*, and *oidium albicans*, we have only the toxines generated by such agencies as *bacterium termo*, *bacillus coli communis*, and others of weak pathogenic agency. Also to the fact that, as scarcely one single infant escapes constipation during the first year of life, though very many do diarrhoea, we may fairly suppose that they must all acquire immunity from the simple toxines of the bowel in health; some infants doing so easily, others with more or less difficulty, this being simply a matter of degree.

It is then possible to understand how these toxines while easily inhibiting the motor mechanism of the bowel and bile-expelling mechanism (and in this respect I have often noticed the effects of 1—2 grains of potassium bromide, administered the previous night, in procuring a free evacuation next morning), are, nevertheless, insufficient to act on the tone of the vessels, or to call the vaso-dilator power into action; thus, whilst delaying the passage of the faeces, they allow absorption to go on unchecked. Also, by the renal effort to free the circulation from the products of decomposition, there is an increased tendency to urination, and consequent further drain of fluid from the bowel.

There is then an increased absorption of bile from the canal, with consequent diminution of its activity there. Here then we have a moderate vicious cycle. A marked increase of residual food acting mechanically, and an increase of decomposition from these

and added agencies, may easily bring on loss of tone and vaso-dilator action, and reflex stimulation of the motor mechanism, with only partial stimulation of the bile expelling mechanism, whilst the secretory function of the liver is partially inhibited, and a resultant green diarrhoea will accrue; which, allowed to progress, may upset the nerve centres and become inflammatory, and go on to total vaso-motor paralysis, ulceration, and even a fatal termination.

In considering post-diarrhoeal constipation we must bear in mind, that owing to the loss of tone and excessive discharge from the bowel wall during an attack of diarrhoea, there has been little or no absorption into the bloodstream; consequently most of the systemic phenomena, such as pyrexia, rapidity of pulse, and nervous prostration, must be put down to reflex influence and the excessive drain on the general system.

When, under suitable treatment, these influences are for the most part lessened, then the returning tone in the vessels promotes greater "pull" on the contents of the bowel, with absorption of the products of decomposition which can never be regarded as totally abolished by the cessation of excessive discharge from the canal, and continue to play a lesser influence than previously. The excessive previous drain on the systemic fluid resources must be made good, and this is undoubtedly done at the expense of the moisture within the lumen of the canal.

The toxines being now taken into the circulation along with any small amount of bile finding its way into the canal, as instanced by the increased pigmentation of the urine, the kidneys are stimulated to free action, and thus dryness of the canal is further increased.

Add to this fact the need for rest after excessive action of the motor mechanism of the bowel, and any slight sedative effect the diminished toxines might produce, and the picture is complete.

It behoves us then to continue for a while, after diarrhoea has ceased, to treat for septic influences.

CHAPTER V.

A SHORT CLINICAL REVIEW OF DIARRHÉA PROPER.

GASTRIC Catarrh, Simple Enteric Catarrh, Acute Inflammatory Catarrh, affecting the small intestine and stomach in one form (*Gastro-Enteritis*) and in the other (*Enterocolitis*) the small intestine, the colon and rectum, also ulceration of the bowels, are all more or less subject to the same causes, and the features of the diseases partake very much of one common type as viewed from the standpoint of this treatise. Given any possible outside cause such as chill, etc., acting as the determining cause to an attack, by producing temporary loss of resistance; or the irritation of over-taxation by unsuitable diet, both in relation to character and quantity of food and relative power of the digestive secretions; or lastly the particular chemical irritation produced by the access of milk-decomposing fungi, commonly known as *Bacterium Lactis*,¹ *Bacterium Butyricum*, *Oidium Albicans*, the last not only possessing the power to act on casein in very much the same way as the others, but also having the power to affix itself to the mucous membranes of the mouth, pharynx and oesophagus, and to the rectum, and skin of the nates, and thus producing direct irritation of the tissues, chiefly due to butyric and formic acid; all may be regarded as ultimately leading to septic conditions.

Further, in 1891-92, I conducted a series of experiments, embodied in a thesis, which tended to prove that from the sour "must" of an unclean jug the disease "thrush" can be directly caused. From the faeces of some cases of diarrhoea, after cultivation, and from the scrapings of the skin of the nates, thrush could also be produced.

Inasmuch as from the faeces of some cases which had not

¹ Duclaux, Ann. de l'Institut Pasteur Vol. ix.

excoriation of skin of nates, I failed to produce thrush, I concluded that in cases where excoriation is found, the oidium albicans may safely be concluded to be present somewhere in the canal, even though the mouth and tongue show no signs, or are apparently quite freed from it after it had previously existed.

In this respect it is as well to mention that because an infant suffers from even severe excoriation of the nates, and though the thrush fungus cannot be found in the mouth, there is no need to rush to the conclusion, as so many are prone to do, and put the cause down as "specific." It might in some cases be so, but is more often than not non-specific.

We can now draw the clinical picture through all these diseases and prove them more or less continuations or advances in degree one of the other.

Gastric Catarrh, arising from any of the above causes, by reason of the impairment of digestive processes, must of necessity reflexly inhibit secretion of bile.

Residual casein passes into the small intestine, meets insufficient bile, is further acted on by decomposing agents, the products of which are (1) chemico-mechanical irritants, such as lactic acid in excess and butyric acid; and (2) other products which act somewhat physiologically as ptomaines.¹ All these produce more or less tumefaction of the mucosa; inhibit vaso-motor action; cause increased irritability to nerve stimuli, the casein itself acting mechanically as a foreign body, the distension from hydrogen, and carbonic acid gases further irritating by pressure on an already damaged mucous membrane; and thus a vicious cycle of great importance is set up.

This irritation, as a whole, may never be of sufficient duration or intensity to lead to more profound circulatory and nervous influences, general and local; and may, under suitable treatment, subside; or, on the other hand, produce pyrexia of distinctly nervous origin, bring vaso-dilator influences into action, produce

vaso-motor paralysis of greater or less degree, over-excitability of motor mechanism, and acute inflammatory diarrhoea may then set in; and, according to the intensity of the irritants and the resistance of the individual, we get secondary cholera infantum, early or late in the disease.

Over-irritation may at certain spots, such as in Peyer's patches, solitary pollicles, or ridges of mucosa, produce stasis and local death with sloughing; and then we have ulceration, which calls for treatment according to locality, as to whether it is situated in the small intestine (pus, blood, shreds of mucosa in stools, chronicity of diarrhoea, *no tenesmus*) or low down in the region of the area for the reflex stimulation of the defaecatory centre, as colon and rectum, when we have all the above symptoms, *with tenesmus* and a form of so-called dysentery; this latter form calling for an important and clearly indicated modification in treatment. Or we may get both forms of ulceration in the same case.

It is at these stages that we are called upon to consider the probability of other strictly pathogenic organisms, such as diplococci, streptococci, and staphylococci, finding a suitable nidus and bringing their special action to bear as factors of direct septicæmic results (pyrexial and other).

I have seen these organisms in chronic cases and in ulceration, dysenteric and otherwise, but have not succeeded in assigning any particular train of symptoms to any one of them. As regards true dysentery, given all the factors of causation before mentioned, I consider that besides general septic conditions, there is undoubtedly specific causation. I have myself suffered from a severe attack of this disease, contracted by direct infection from sleeping in a bed previously occupied by a similar case, the dysentery being complicated by a rectal abscess. I again suffered from dysentery in Edinburgh whilst attending a case of acute suppurative cellulitis of the upper limb. I have seen the dysentery of this climate, but have failed to observe the amœba coli even after careful search.

CHAPTER VI.

AN INTERESTING DIGRESSION.

THE following epidemic will be of interest:—In March, 1894, five little children, belonging to two families of adjoining houses, the drains of which were in good order, played in a back garden, abutting on which was an overflowing ashpit, and fell dangerously ill. One little girl suffered from perhaps the worst attack of exfoliative putrid dysentery I have ever seen, and hovered between life and death for three weeks and recovered.

Her little sister began at the same time, but was soon rapidly well under the same treatment.

A younger child in the other family took ill at 11 p.m. one night and was dead of hyperpyrexia by 3 a.m. on the following morning. Death in four hours.

A little boy, slightly older—five years—was then struck down with diphtheria, membrane in fauces, and double suppurative otorrhœa, no rash. He desquamated slightly, and ultimately recovered.

His elder sister—ten years—went down with acute exfoliative dysentery and sore throat. Although there was no membrane, this case was, I think, diphtheritic. After two weeks' illness she recovered.

In all of these cases, with the exception of the one that died, I was able to observe and separate diplococci and streptococci. I myself got a sore throat, as also did another member of my family.

I advisedly advance that this epidemic of dysentery was diphtheritic, perhaps erysipelatous, in nature. I can, myself, see no cause operating naturally within the canal which would prevent such diseases from attacking the mucosa of the bowel as a primary disease. There were no Klebs-Loeffler bacilli visible, and it was shortly before the serum treatment of diphtheria came out.

CHAPTER VII.

IMPORTANT BEARINGS OF FREQUENT AND INFREQUENT INTESTINAL
EVACUATION.

WE may now examine the motor functions of the Tract in these affections.

In the healthy infant, under normal conditions, nature has made provision that there shall be at least three evacuations of the bowels during the twenty-four hours.

Here seems to be a clear indication that the main point is to at once remove all decomposing and irritating material as soon as possible.

Under conditions of disease there is an increase of evacuations, showing that then, more than before, is the necessity urgent.

To argue on the frequency of evacuation, as indicative of more than a roughly approximate condition of an infant or of the progress of the disease, is frequently misleading, and conduces to error if depended on to indicate from infrequency returning health, or from great frequency an excessively grave prognosis.

An infant may easily be evacuating its bowels twice or three times as often as another child, and yet be in far less danger of an ultimately fatal issue.

To endeavour to prevent a most natural occurrence, as advocated by some authorities, is entirely fallacious, and will inevitably cause disaster sooner or later to those who practise it.

Let frequency of evacuation at most act as an indication of something out of gear elsewhere, and endeavour to direct and control it within reasonable bounds, rather than pursue the mistaken policy of repression advocated by many, and to which end existed a vast armamentarium of astringent drugs in combination with narcotics.

On the other hand, cessation or marked diminution of evacuation is often followed by recrudescence of the disease; may be symptomatic: or, if artificially produced, may be causative of such recrudescence.

I have repeatedly noticed that should a convalescent case be allowed to remain without an evacuation of the bowels for more than six hours, the temperature and pulse will rise and be followed by a return of the excessive flow.

This used frequently to occur under the repressive treatment, to be followed by renewed effort on the part of the medical attendant, with the result which most of us have seen from time to time.

The importance of this point cannot be too fully impressed on those who desire to treat infantile diarrhoea rapidly and successfully, with due regard to the septic conditions of the canal. Nearly all the chronic, ulcerated, and prolonged cases of diarrhoea arise from or are kept up by deficiency of action of the bowel, or have been artificially induced by endeavouring to cure the disease by preventing evacuation of contents of the bowel.

It is well to bear in mind that the contents of the bowel, viz., the food refuse and intestinal secretions are, so to speak, outside the body physiologically. The hyper-secretion must be stopped at the point of being poured out into the lumen.

Therefore, frequency of evacuation is not even a necessary symptom of diarrhoea. It is distinctly a natural therapeutic method of cure, and is strongly indicated. It is not the evacuation *per se*, but the painful contraction and irritation of a highly receptive and sensitive reflex system, loss of fluid, and deranged vasomotor mechanism that is the evil factor which should be treated, whilst the already thrown-off material should be at once removed as an absolute necessity for obvious reasons (septic absorption).

Here then we see the extreme importance of a thorough knowledge in the use of opium and allied preparations in Infantile Diarrhoea, the inestimable value of the moderate and discretionary use of the drug, and the great liability of being led into error by

its use to such an extent as to abolish motor action and to maintain the condition of torpor.

Endeavour, as far as possible, to subdue sensory reflex with its harmful consequences, and the need for evacuation will cease. Excessive frequency indicates profound changes in the bowel wall, and can only be rationally treated by direct attention to the source. Repress evacuation, under mistaken ideas, and the damage to the intestinal walls will continue to progress in degree, either to a chronic or fatal termination.

A young and inexperienced practitioner is very prone to be unduly influenced by the attendants on a case to attempt the repressive treatment. If he yields, then he lays the foundation to probable ulceration, chronic diarrhoea, or acute vasomotor paralysis (*false Cholera Infantum*), and then when alarmed persisting in the same course, conduces unwittingly to a fatal issue. Non-evacuation, on the other hand, is a distinct factor to be dealt with, and calls for prompt attention from an aseptic point of view.

These are two of the most useful items in treatment which the careful study of the bacteriology of Infantile Diarrhoea has brought out.

Remove the need for very frequent evacuation by rendering the contents of the canal less septic, less fermentative, less irritating, diminish the excessive flow from the bowel wall by re-establishing the tone of the vessels, and the excessive frequency disappears of its own accord.

CHAPTER VIII.

THE SALIVARY, GASTRIC, PANCREATIC AND INTESTINAL SECRETIONS.

CHIEFLY owing to the imperfect development of the salivary glands, the salivary secretion of the infant under one year of age differs from that of the adult in that the special amylolytic action is almost wholly absent, or too feeble to have any appreciable action on the granulose of starch; at any rate till the latter part of that period.

Since the action of ptyalin is to convert the granulose of starch into dextrine and dextrose in the adult, and we find it to be practically inactive, if present, in the infant, there seems to be a clear indication for the total absence of all starch food under one year of age.

According to Maly,¹ the gastric mucous membrane when digested with dextrine and dextrose produces lactic acid.² Starch is also capable of acetic fermentation. We shall see when dealing with gastric digestion and fermentation the part lactic acid plays as a factor of irritation. We are constantly introducing starch and dextrines into the infantile stomach in the form of barley water, or some patent starch food or other, which is either purely starch and depends on excessive cooking, which it seldom or never gets; or is some preparation of starch food dependent on some enzyme, said to be present, which will act satisfactorily if cooked after a certain particular manner, with the result that in nearly all cases an infant is fed with practically raw starch, on which its saliva has little or no power; and so even this first aid to digestion is absent.

The starch, often at best in a more or less partial condition of

¹ Maly: Liebig's Ann., Bd. clxxiii. (1874). Lister: Path. Soc. Trans. (1873), p. 425. Micro-organisms.

² Hammarsten: Maly's Bericht, Bd. ii. (1872).

being cooked or converted to dextrine or dextrose, finds its way into a stomach clearly not yet intended to receive it, from the plain indication given by the absence of amylolytic power in the saliva. And thus we come to find starch-feeding playing a very important *rôle* as a factor conducive to irritating fermentative action in the stomach.

From this we can understand that no starch food, such as barley water or other purely starch compound, should be given to an infant under one year of age, still less to an ailing infant. Foods dependent on some further action at the hands of attendants on an infant had best be avoided, as they are seldom if ever satisfactorily prepared, and their very mode of preparation renders them particularly liable to contamination.

Should, for various causes, a preparation be desired as an adjuvant to the natural food of the infant, then it is better to use some preparation which is already an ultimate product of a completed process.

From long practical experience of such foods, I find the preparation best suited to young, delicate, and ailing infants, suffering from irritable conditions of the stomach, to be an ultimate malted cereal, consisting entirely of maltose in combination with the casein of milk, which is also altered and reduced by the action of the malting process. This preparation, which is commercially known as Horlick's Malted Milk, is extremely simple in composition, and is not only useful in its existing proportions, but permits of the addition of further fresh casein, and has the power of acting on, and reducing that also.¹

As in adults, the infantile saliva has no action on proteids and fats, other than the promotion of taste, if even that. We cannot leave the saliva without bearing in mind the peculiar liability of the infantile mouth to act as a vehicle for germs into the alimentary canal. This point has an important bearing on the sterilization of milk.

The buccal cavity bears an important part in its liability to become infected by the thrush fungus.

¹ See Appendix.

This organism possesses the power of decomposing milk in a like manner to the *bacterium lactis*, with the formation of lactic acid.¹ Some writers also attribute its extreme locally irritating action to an allied butyric action; others, to a slight formic action.

Whatever the action, the fact remains, that whenever the thrush fungus appears in the mouth, one may sooner or later look for symptoms of intestinal derangement. Though it is said only to attack the mouth, rectum and nates, yet it may probably affect the pharynx and oesophagus in a weakly case; and though patches of the *oidium albicans* may not be seen on the surface of the stomach and bowels, yet it may irritate them much in the same manner as it inflames the mouth before one is able to demonstrate its actual presence.

That it can and does produce diarrhoea, I have carefully proved over and over again by most careful investigations as mentioned in the early part of this article. In cases of chronic diarrhoea, which prove obstinate, minute and careful examination of the mouth will reveal some small focus hidden away out of reach of an ordinary examination, and its removal will at once be followed by improvement.

The thrush fungus must on no account be permitted to remain an instant in contact with the mucous membrane of the mouth after discovery. Its removal must not be delayed till it will separate without bleeding; but it should be mechanically detached, in spite of everything, and this is best done with a dry cloth or handkerchief, which should at once be burned or disinfected by boiling. The physician should do this himself. The denuded membrane and the whole mouth should be regularly and periodically treated with some mild non-irritating antiseptic, such as, weak carbolic, permanganate of potash, boroglyceride, salicylate of soda, etc., at intervals of two or three hours.

Irritation in the mouth of an infant has a powerful reflex influence in deranging the stomach and intestines.

¹ Hallier.

In this connection any teeth pressing upwards on the intact gums should be duly sought for and at once released by lancing.

Like most things, lancing the gums was enthusiastically hackneyed and abused, to be followed by a revulsion of feeling, and an equally senseless total abandonment of the procedure.

Only great benefit can accrue to a sensible and rational use of the operation ; and, in view of the profound general unrest and suffering as well as the deleterious influence on the rest of the functions and conditions of the canal, it is strongly to be advised and urged as a thoroughly sound method of relieving tension when it is clearly ascertained to exist.

GASTRIC SECRETIONS AND PROCESSES.

The gastric juice, containing pepsine and hydrochloric acid in the adult, possesses a special action on proteids, with the production of peptones and parapeptones.

It is said to have no special or appreciable action on fats, though, undoubtedly, some decomposition of fats occasionally takes place with production of certain fatty acids as acetic, propionic, lactic, and butyric. These are most probably the result of extraneous fermentation brought about by organized ferments introduced into the stomach in conjunction with improperly kept and prepared food, or taken from the atmosphere.

Pepsine is said to have no action on carbohydrates, such as starches and sugars, though dextrines, dextroses, and cane-sugar possess a distinct *laevo*-rotatory action after digestion with mucous membrane of the stomach¹.

This might be due to the action of the hydrochloric acid² acting alone, or in conjunction with some ferment said to be present in the mucus of the stomach under certain conditions, perhaps in mucus secreted under adverse circumstances, and hence of an imperfectly elaborated nature. Further, this action may be due to

¹ Hammarsten, Maby's Bericht (1881.)

² Wohl. Ber. Chem. Gesell. Jahrg. xxiii. (1890).

extraneous organisms, and be quite apart from gastric digestion proper.

The juices of the adult stomach also appear to possess the power of dissolving cell envelopes, and thus setting any contained proteid free to the influences of peptic digestion.

This, the gastric juice of the infant, is totally unfitted to perform; perhaps from its feeble corrosive action in one respect, yet its digestive powers in another are somewhat stronger relatively than those of the adult.

This latter refers to the power it possesses of digesting casein, a proteid present in large proportion in the natural food of the infant, existing free and unenclosed by any cell envelope.

A greater proportion of infants are found capable of digesting casein, under suitable circumstances and in proper proportions, than are adults.

This property of infantile digestion is said to be due to the presence of renin, a special hydrolytic ferment of casein, present in the stomach of children and calves,¹ but deficient in the adult gastric juice.

As cow's milk is the staple of hand-fed infants, it seems well to carefully consider its special properties in regard to the infantile digestion and in comparison with human milk.

The curd of human milk is possessed of a distinctive property in comparison with that of a cow.

In some cases the resolution of human casein into peptone takes place without much appreciable so-called "clotting"; when it does "clot," the curd seems to be more loose, and the texture more gossamer-like than that of cow's milk, which is tougher and closer in composition as well as relatively coarser in fibre, if it may be so termed.

The process of clotting of milk appears to be an alteration of the molecular structure of the casein by renin, producing a substance allied to and resembling casein, called tyrein, but

¹ Hammarsten, Ludwig's Festg. Leipz. (1875).

differing in chemical properties, being less soluble in acids and alkalies.¹

This difference in physical and molecular composition brings an important factor into play when considering the power the infantile gastric juice has of reducing a given quantity, in given proportion, in a certain fixed time. It also appears to be sooner exhausted in reducing cow casein than the same quantity of human curd. This is a factor too often neglected in the composition of an artificial human milk made from cow's milk.

The relative digestibility of the two curds amounts to from half to one per cent. in actual composition, when cow casein is given to the infant.

Thus, a composite food containing cow casein should, actually, to be equal to human casein in solubility by infantile digestion, be present in the mixture in proportion of from half to one per cent less than the percentage of human casein; that is, roughly, human casein being three per cent., then cow casein should, in a proportion of from two to two and a half per cent. or less, be the equivalent, taking into consideration its resistance to infantile digestive action. Indeed, in some young infants, cow casein is hardly admissible at all, and we must depend on the soluble albumins, other than casein, for sustenance, and are compelled to fall back on the "whey" alone.

I carefully proved this relativity by numerous experiments on healthy infants with human milk expressed from the breast, noting the quantity, and the time taken to digest the same, and the residue of curd, if any, remaining at the end of that time; and calculating a like proportion of cow casein as human casein (viz., three per cent.) I noted the time an equal quantity of composite milk, containing three per cent. cow casein took to digest, and also the residue present, and found, invariably, there was a half to one per cent. more residue (after use of stomach pump) in a given bulk of gastric contents withdrawn, than in the case of human milk.

¹ Al. Schmidt, *Beitr. z. Kennt. d' Milch Dorpat* (1874).

This is important as showing the fact that composite milk containing the same percentage of cow casin as human milk (that is three per cent.) will be liable to err on the side of overtaxation of gastric action. This will not fall in with the views of the advocates of feeding infants by rule of thumb, and by tabular methods, but that cannot be helped. It is better to give less casein, and to get it completely and easily digested in almost its entirety, than to give too much casein, though in conformity with measure tables, and have overtaxation, impairment of digestion, and consequent increased residue to be passed on into the bowel to produce fermentative and putrefactive irritation; and constipation, or diarrhoea, according to the degree of such irritation.

If this is applicable to a healthy infant, how much more to one of impaired powers, or to one actually in a condition of marked ill-health.

It is not till the latter months of infancy that the digestive powers have sufficient surplus energy to enable them to attack cow's milk without relation to its increased resistance, proportion for proportion of casein, compared with human milk. In this connection the idea that the preparation of cow's milk by prolonged heating under the boiling point of milk,¹ and the power which such heating is said to possess of changing the character of the clot by rendering it more soft and more brittle, is partially incorrect, being based on inaccuracy of observation; milk thus prepared possessing the following further and hitherto unmentioned properties, which to my mind will cause its abandonment in the future.

The clot (though more soft and brittle, as observed before breaking up the curd) has the peculiar power of forming itself into multiple clots of tougher and harder consistency than before prolonged heating, and if agitation be practised on the granulated curd, as that of the gastric movement, these granules of curd will be seen to possess the property of running together and adhering into a hard, tough, round mass of the consistency of an india-

¹ Budin and Chavane.

rubber cricket ball. This is clearly a drawback, and a difficulty for infantile digestion.

This process probably owes any virtue it may possess to the destruction of extraneous fermentative germs, which are killed at a lower temperature than the boiling point of milk.

This benefit can just as easily be obtained by raising the milk rapidly over the boiling point twice or thrice, and by constantly stirring with a spoon during boiling.

On the other hand, I have found that the addition to milk of an active extract of malt will produce a marked change in the consistence of the curd of cow's milk. It is in finer division, does not contract down, and is altogether altered by the action of the diastase to resemble the normal curd of human milk.¹ Malt extract possesses also the power of imparting to milk a more satisfying sweetness and pleasantness to the infantile palate than artificial sugar of milk, which has a distinctly disagreeable chalky taste.

This effect is produced by relatively less malt than cane or milk sugar, though not so perceptible to the adult palate as "sweetness."

Infants with habitually foul tongues, though apparently in otherwise good health, at once lose the "fur" and sourness of breath on the adoption of a small quantity, half a teaspoonful and less, to every bottle of milk in lieu of any other sweetening agent.

Any gastric contents, removed during the use of malt extract or powdered malt, are found to be softer, more divided, and in a further stage of dissolution in a given time than without its use. Any improvement may be put down to the fact that the malt is an active agent; the carbohydrate contained is an ultimate product, and, in the absence of extraneous ferments and given with milk aseptically pure, leaves less residual curd to ferment in the stomach and intestines, yet does not prevent the salutary stimulation of functional action of the stomach on the curd also.

¹ Personal Experimentation (1891).

Maltose is also less capable of lactic and butyric acid fermentation than is lactose in a given time.

As regards the amount of fats normally present in human milk (4 per cent.), we must bear in mind the probable action of any residual fat acting, as most oils do, directly on the bowel wall, in producing an increase of mucus and consequent fluidity of the faeces, and thereby causing an aperient action. Its presence in moderate quantity tends to produce a salutary effect, an excessive surplus conduced to the production of fatty acids in the presence of decomposing curd, and adding to the sources of irritation. This point is important when administering certain quantities of cream to infants suffering from diarrhoea of a fermentative nature. This is, of course, outside the nutritive benefits of fat to the infantile organism.

Pancreatic Secretions.—The function of the pancreas in the adult is of a complete nature. Whereas the gastric juice and the saliva possess a selective action on certain constituents of food, that of the pancreas is universal in its scope, acting on proteids, hydrocarbons and carbohydrates equally well. We know that the salivary glands, to which the pancreas approaches very much in structure, are only partially developed during early infantile life, and that, in consequence, their secretions are somewhat feeble in action.

With pancreatic action artificially induced, and normally in the adult, we are accustomed to associate certain distinctive features, such as extractives, from the dejecta and characteristic odours.

We find such extractives in very small amount relatively in the infant, and an entire absence of any odour at all resembling that of pancreatic action, with or without the adjuvant action of organisms. From these facts we are inclined to deduce that the power of the secretions of the pancreas are, for the same reasons as the salivary secretions, somewhat in abeyance, and such is most probably the case.

Yet there must be some slight action from the fact that one of

the constituents of infantile dietary is fat, and that fat is more or less necessary to the infant; that one of the functions of the pancreatic juice is, acting alone or in conjunction with the bile or succus entericus, to elaborate fat for entry into the general system. Perhaps, in a small degree, this process is normally assisted by extraneous action of those organisms which conduce to the formation of free fatty acid said to be necessary to the due emulsification of all fats. Such being the case, there must also be some action, even though feeble, on proteids, since proteids form so large a proportion of infantile aliment.

On carbohydrates, there is probably still less action, perhaps none for some time after birth, thus keeping up the analogy with the salivary glands. And from careful examination of the faeces in experiments conducted under conditions of fixed proportions of proteid food over a certain time, and careful observations on the amount of residual proteid present in the faeces; and then the addition of a fixed amount of starch, and a calculation of the approximate difference in weight and amount of unaltered starch present with residual proteid, I cannot say that there was any appreciable action on starch, to judge from the amount passed during a certain time, and in comparison with that administered by the mouth, making due allowance for that which would be lost by fermentative action other than by the pancreas. These experiments can never be exact for obvious reasons. Nevertheless, more unaltered starch granules were found in the dejecta of an infant five months old than in one of nine months of age, fed on the same quantity. This, being so under conditions of health, must be still more marked under conditions of disease.

We may therefore conclude that the trypsin and steapsin of the pancreas are feeble in action, if at all active, and amylopsin almost totally inert, if not absent, in the infant under one year.

Intestinal Secretions.—The succus entericus is said to exert an action on milk analogous to the action of pepsine on milk in the adult. This is probably due to the pepsine which may find its way into the duodenum from the stomach, or to the

cells in the duodenum secreting pepsine as asserted by some authorities.

It is also said to convert rapidly cane into grape sugar, and also cane-sugar in the presence of decomposing milk into lactic and butyric acids, with the liberation of carbonic acid and free hydrogen, also to split up neutral fats. These are all properties more or less disputed by various authorities.

The probability is that, apart from the action of the succus entericus, the milk ferments are more or less constantly present in the intestine under all conditions, and that to them is due the decomposition occurring in fats and carbohydrates, giving rise to the fore-mentioned products.

This is still more probable in the intestine of the infant, in which milk curd is constantly present in various stages of decomposition, according to circumstances. We must not here forget the special selective actions of the cells of the mucosa, the "pull" of the blood-vessels on the fluid contents of the bowel, the passage of fat into the lacteals, and, finally, the degree of dryness and moisture brought about by variations in the tone of the blood-vessels, and the increased or diminished secretion of mucus into the lumen under direct stimulation.

The possibly strong influence which the lymphoid tissue, Peyer's patches, and solitary glands exert in preventing the entry of organisms into the system must be borne in mind. We know that they are swollen and much affected, even ulcerated, in cases of chronic diarrhoea, and Peyer's patches are particularly affected by the typhoid bacillus.

Before leaving this subject, it is as well to bear in mind the probable direct action the bacteria of the intestine exert in producing a further and more complete disintegration of food, over and above that already exerted by the strictly physiological enzymes of the secretory glands. In this respect a valuable paper on the subject will be found in Vol. XXVI., *Journal Anat. and Physiol.*, by Dr. A. MacFadyen, in which he fully discusses the probability of the toxins or tox-albumins, generated from the proteolytic action

of bacteria, as being nearly related to or are themselves enzymes in their action on proteids and also in some cases on carbohydrates, besides any special effects these tox-albumins or enzymes may have in the system generally. In another paper in Vol. XXV., *Ibid.*, where he, along with Drs. Nencki and Sieber, enters into a most interesting study of various organisms found in the intestine of man as regards their nature and products, such as acids, gases, and toxic derivatives. He there seems to come to the conclusion, and perhaps rightly, that the human organism is able to elaborate all it needs from the food by its own unaided secretions, and that the products and actions of micro-organisms are not needed and are in many respects most harmful. The reader is also referred to some work by the same author of a much earlier date on the bacteria of the digestive tract, Vol. XXI., *Ibid.*, in which the results arrived at, especially in relation to the antiseptic action of the bile, have not been borne out by personal clinical experience, and by the somewhat significant trend and penchant of the medical practitioner for grey powder, which is merely a liver stimulant, and does not exert any direct antiseptic action such as calomel; thus in a great measure tending to controvert or disprove, by the test of actual practice, conclusions experimentally arrived at in the laboratory under highly-skilled management. Nevertheless, the reader should avail himself of the opportunity to see these papers and form an independent personal opinion after their perusal, as they are more than worth the necessary trouble for many other reasons.

CHAPTER IX.

BILE.

IN the adult we know that the bile is an all important factor in intestinal digestion. It is :

(1) Antacid, neutralises the gastric acidity, destroys pepsine, precipitates residual peptone and para-peptone, and renders the contents of the stomach, after passage into the intestine, more suited for the action of the pancreatic and intestinal secretions.

(2) Acting in conjunction with the pancreatic and intestinal juices, it emulsifies fats after their saponification by the pancreatic secretion. It also acts as a vehicle for the passage of fat through the mucosa.

It is also said to have a subordinate action in converting cane sugar and starch, but this is still doubtful.

(3) Persistalnt. It is nature's stimulant for the motor action of the bowel ; is mild, equable and regular in action and non-irritating. In this respect it is most valuable in infantile diarrhoea.

(4) Antiseptic. It is nature's great provision for retarding the fermentative processes in the bowel due to action of organisms. On its presence or absence in greater or less proportions, depend the maintenance of health or the facility with which extraneous processes can be set up, tending to the production of disease.

On careful experimentation I found that a solution of gelatine peptone, when containing a fair proportion of bile from a puppy, retarded the action of putrefactive bacteria for a period of from twelve to twenty-four hours longer than an equal quantity of the same material under similar conditions not containing bile. The same experiments were frequently repeated with peptonised milk under "control" and also with fresh urine satisfactorily.

The addition of a small, almost infinitesimal quantity of calomel seemed to assist the action of the bile in other experiments. Calomel when given to the puppy some hours before by mouth seemed to act much in the same manner.

Grey powder did not seem to affect any increase of retarding power of bile on putrefaction of peptone, when given by mouth or added artificially to bile.

Neither did such liver stimulants as podophyllin, iridin, leptandrin, etc. Hence there must be special properties due to the calomel itself, as we already know, and not solely to its being a liver stimulant.

Seeing the important rôle of the liver in the adult, and its relatively larger size in the infant, one is led to suppose that its secretion would be of greater value in the processes of the infantile digestion ; and such undoubtedly is the case, as we shall see when considering the treatment of infantile diarrhoea.

The liver, next to the stomach, is one of the most important organs belonging to an infant or young child in the maintenance of health, even more so than in the adult. We know that the secretion of bile is constantly taking place, is increased by the introduction of food into the stomach, and markedly so by its entry into the duodenum, when the bile-expelling mechanism is called into action.

Though the liver is constantly secreting bile, and there must therefore necessarily be a constant though lessened flow into the bowel during the intervals between the ingestion of food, yet, like all secreting glands, it is controlled by nervous influence, and though stimulation of the gastric mucous membrane does accelerate the secretion of bile, we can fully understand that it is also subject to inhibitory influences under certain conditions.

We know that in febrile states all the secretory glands of the body suspend their action.

We can easily conceive that, under conditions of extreme irritation of the mucous membrane of the stomach and intestine, there may be a direct controlling influence on the secretion of bile and its discharge into the bowel.

This inhibitory reflex may never be sufficient to produce a total cessation of bile, but may be quite sufficient to produce so marked an influence, as to reduce the amount of bile finding its way into the bowel to less than is adequate to control or retard fermentative and putrefactive changes taking place within the bowel.

The increased fluidity of the faeces, in an attack of diarrhoea, is probably due to increased flow from the capillaries of the bowel wall, by reason of loss of tone in the arterioles, and rise of blood pressure elsewhere than in the portal system, with consequent suspension of absorption from the canal. There is also the increased secretion of mucus from the walls of the canal. It is quite possible that a stimulus, sufficiently strong to be able to produce these changes in the stomach and intestines, may also exert an inhibitory reflex on the bile mechanism.

Just as some conditions of the gastric mucous membrane are able to inhibit cardiac action though the vagus, so by the fibres of the right vagus acting in conjunction with the sympathetic and the vesicular column of Clarke in the spinal cord, the stomach may exert an analogous influence on the liver by the so-called anabolic nerve fibres.

Again, the mucous membrane of the bile ducts may reflexly take part in the general tumefaction and produce a backward pressure on the bile current with consequent diminution of the amount finding its way into the bowel, and an increase of absorption into the blood stream from the hepatic system. This fact possibly accounts for the slightly icteric hue of the skin in some cases of chronic diarrhoea; and in other cases of constipation, with sub-acute catarrhal affections of the stomach from unsuitable food, or from fermentative action in the stomach; with increase of urobilin in the urine. Or, perhaps, this icteric tint may be due to increased absorption of any bile in the bowel, which may be favoured by the deficient motor action brought about by the septic condition of the canal, with increased kidney action as a consequence. In this respect the marked increase of urine passed by children suffering from constipation, with deficient digestion and

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The increased fluidity of the faeces, in an attack of diarrhoea, is probably due to increased flow from the capillaries of the bowel wall, by reason of loss of tone in the arterioles, and rise of blood pressure elsewhere than in the portal system, with consequent suspension of absorption from the canal. There is also the increased secretion of mucus from the walls of the canal. It is quite possible that a stimulus, sufficiently strong to be able to produce these changes in the stomach and intestines, may also exert an inhibitory reflex on the bile mechanism.

Just as some conditions of the gastric mucous membrane are able to inhibit cardiac action though the vagus, so by the fibres of the right vagus acting in conjunction with the sympathetic and the vesicular column of Clarke in the spinal cord, the stomach may exert an analogous influence on the liver by the so-called anabolic nerve fibres.

Again, the mucous membrane of the bile ducts may reflexly take part in the general tumefaction and produce a backward pressure on the bile current with consequent diminution of the amount finding its way into the bowel, and an increase of absorption into the blood stream from the hepatic system. This fact possibly accounts for the slightly icteric hue of the skin in some cases of chronic diarrhoea; and in other cases of constipation, with sub-acute catarrhal affections of the stomach from unsuitable food, or from fermentative action in the stomach; with increase of urobilin in the urine. Or, perhaps, this icteric tint may be due to increased absorption of any bile in the bowel, which may be favoured by the deficient motor action brought about by the septic condition of the canal, with increased kidney action as a consequence. In this respect the marked increase of urine passed by children suffering from constipation, with deficient digestion and

The addition of a small, almost infinitesimal quantity of calomel seemed to assist the action of the bile in other experiments. Calomel when given to the puppy some hours before by mouth seemed to act much in the same manner.

Grey powder did not seem to affect any increase of retarding power of bile on putrefaction of peptone, when given by mouth or added artificially to bile.

Neither did such liver stimulants as podophyllin, iridin, leptandrin, etc. Hence there must be special properties due to the calomel itself, as we already know, and not solely to its being a liver stimulant.

Seeing the important *rôle* of the liver in the adult, and its relatively larger size in the infant, one is led to suppose that its secretion would be of greater value in the processes of the infantile digestion ; and such undoubtedly is the case, as we shall see when considering the treatment of infantile diarrhoea.

The liver, next to the stomach, is one of the most important organs belonging to an infant or young child in the maintenance of health, even more so than in the adult. We know that the secretion of bile is constantly taking place, is increased by the introduction of food into the stomach, and markedly so by its entry into the duodenum, when the bile-expelling mechanism is called into action.

Though the liver is constantly secreting bile, and there must therefore necessarily be a constant though lessened flow into the bowel during the intervals between the ingestion of food, yet, like all secreting glands, it is controlled by nervous influence, and though stimulation of the gastric mucous membrane does accelerate the secretion of bile, we can fully understand that it is also subject to inhibitory influences under certain conditions.

We know that in febrile states all the secretory glands of the body suspend their action.

We can easily conceive that, under conditions of extreme irritation of the mucous membrane of the stomach and intestine, there may be a direct controlling influence on the secretion of bile and its discharge into the bowel.

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septic changes in the bowel, accompanied by absorption of their products, is most striking.

There is also a great tendency for the urine voided in cases of constipation in infants, to undergo fermentation with excessive production of free ammonia, probably drawn from decomposed bile acids, as well as from the decomposition of urea.

This brings us to consider the part played by the bile in the production of green diarrhoea of infants and young children.

Granted any cause which may conduce to a certain amount of deficiency of bile in the bowel, a deficiency sufficient to interfere with its controlling influence on the septic and fermentative changes in the bowel, such deficiency may, for the following reasons, be directly causative of the peculiar phenomena connected with green diarrhoea. One of the components of bile is sodium taurocholate, a sodium salt of taurocholic acid—which is itself a combination of cholic acid and taurin—a sulphur compound with ammonia and ethyl, spoken of by some as amido-isethionic acid, and by others as amido-ethyl-sulphonic acid.

During gastric digestion under unsuitable conditions such as impure milk, or excessive feeding with the use of cane sugar or starch, influenced by the presence of various ferments of which the most important are bacterium lactis and bacterium butyricum, there is a tendency to the formation of lactic and butyric acids, with free carbonic acid and hydrogen; hence the distension commonly found in these cases. The excessive acidity tends to call out an increase of mucus in the attempt to neutralise the same, with increased irritation from the possible decomposition of this mucus by other organisms present, rendering it somewhat acrid in property.

The excessively acid gastric contents finding their way into the bowel, meet with a deficiency of bile, and the probable following chemical re-action takes place.

The sodium is combined with the lactic and butyric acid, producing sodium lactate or butyrate and taurocholic acid, which is further split up into cholic acid and taurin, whether by the

action of lactic acid or by butyric acid in excess, or by organisms, or by the combined action of enzymes altered by circumstances of irritation and the other agents, is immaterial. The taurin is probably decomposed by the reducing action of free hydrogen, with formation of sulphuretted hydrogen and free oxygen, which now easily produces the first stage of the oxidation of bilirubin—known as biliverdin; hence the green colour of the faeces, and the strong distinctive odour of sulphuretted hydrogen which the green faeces possess.

The excess of acid is now neutralised by the free flow of alkaline fluids and mucus from the bowel wall, and therefore the faeces give no acid reaction to test, or the acid is destroyed in the large intestine by the formation of CO_2 , oxygen and marsh gas.

In the case of diarrhoea we have little or no absorption from the canal, consequently the bile acids and pigments remain to be acted on with the above results.

In constipation, on the other hand, there is increased absorption, with the result that, there being less fermentation with its resultant irritation, the bile acids and pigments are at once removed from the canal and appear in the urine as urobilin and carbamides, giving rise to free ammonia on fermentation of the urine.

The action of large doses of mercurials in children, in the production of green stools, is probably due to the fact that after the first rush of bile, which is rapidly carried off, there is exhaustion and consequent deficiency of bile, a small quantity of which remains in the canal, owing to the flow from the bowel wall being into the lumen of the gut, and is there acted on, with production of the characteristic colouration.

In this respect, the action a small dose of an hepatic stimulant will effect in the colour and characters of the dejecta in a case of diarrhoea is most noticeable.

Here the rush of bile, in sufficient quantity, at once neutralises all acids, checks fermentation, and brings about marked general improvement. This is most probably the action of grey powder in

repeated small quantities. Hence its popularity with practitioners in the treatment of diarrhoea of infants. The same result is produced by small doses of Podophyllin $\frac{1}{2}$ gr., Iridin $\frac{1}{2}$, and Leptandrin, repeated at intervals.

Calomel acts pretty much in the same manner.

As also perchloride of mercury, for it is highly probable that they all owe their efficacy to their being bile stimulants rather than to any specific action ; for, were they given in sufficient quantity to act directly as antiseptics, they would undoubtedly destroy surface cells and increase an irritation which it is most imperative to allay, besides poisoning the patient.

With regard to the perchloride of mercury, I have frequently seen it aggravate an intestinal catarrh, with serious consequences ; therefore, it is to be, if possible, avoided, or, if used, must be employed in the most cautious manner.

These results were all obtained without the aid of any extra-neous intestinal antiseptic drugs, such as salol, resorcin, etc.

Further, exactly the same result will be obtained by a timely dose of simple castor oil, for according to Professors Fraser and Rutherford, the oil not only acts equally upon the whole alimentary canal, but reflexly stimulates the bile-expelling mechanism, and is for these two reasons an invaluable drug in the treatment of infantile diarrhoea.

The distinctive colour and odour in green diarrhoea may be then said to be due to the continued presence of bile products in marked deficiency. That of constipation, which is quite different, to the absence of bile products, deficient in the first instance, and that small amount rapidly removed from the sphere of action.

It will be noticed that the odour of faeces in a case of constipation is exactly the same, only in a less degree, as in those cases of non-malignant obstructive jaundice, with a cachexia from the absorption of ptomaines and other products of putrefaction of food usually present during the digestion carried on in the absence of bile and its derivatives.

I have lately had my attention drawn to some cases of enlarged

glands of the abdomen in young children, both the mesenteric glands and the spleen.

In some cases of *tabes mesenterica* and enlarged spleen, the faeces are either hard, whitish, and showing all the signs usually associated with absence of bile, or are loose with characteristic green discolouration.

I was most struck with the rapidity with which the mesenteric glands in four cases subsided after mild continued stimulation of the liver with $\frac{1}{24}$ gr. of podophyllin, administered three times a day along with the salicylate of bismuth, as also in two cases of obstinately enlarged spleens, which yielded at once to the same treatment accompanied by resorcin and salicylate of bismuth.

All these cases had resisted iodide of iron, cod liver oil, arsenic, and the usual routine.

It is highly probable that these were cases of excessive septic absorption due to deficiency of bile and consequent intestinal fermentation.

Three presented the typical, pale faeces with characteristic odour, the others had chronic green diarrhoea. It is a significant fact that nearly every writer on *tabes mesenterica* and enlarged spleen, after describing elaborate methods of treatment ends by directing attention to the need of attending to the digestive functions.

From the foregoing, it is now possible to see that in the bile we possess a most powerful antifermentative agent, acting below the level of the pylorus, and an excellent therapeutic aid in the treatment of the septic conditions of the alimentary canal of infants and young children.

Some French observers attribute the green colouration in diarrhoea to a *bacillus viridis*,¹ but careful cultivation has failed to produce the organism,² whereas, milk decomposed in the presence of bile, under pressure, will produce the distinctive green colour and odour. Milk decomposed by inoculation from green dejecta does not turn green, but a whitish-yellow without the characteristic odour (*bacterium synxanthum* [*termo* ?]).

¹ Lesage.

² Jeffries, Baginsky and Jacobi.

Certain writers attribute the colouration of the faeces to the action of *bacterium synxanthum*, which others assert is nothing other than the ordinary *bacterium termo*; others, to the *bacillus cyanogenus*, which is said to produce a blue-violet colouration of milk; others again to the *micrococcus chlorinus*, or the organism of ordinary green growth; and, finally, there are those who assert that there are many and various phases and stages of development of the *bacillus coli communis*, in some of which stages, it is able to produce green colouration of the contents of the bowels, and under certain conditions of excessive activity, to be able to take on an active pathogenic action, and is the direct factor of inflammatory and ulcerative actions in the canal and also in the peritoneal cavity, all of which latter seems, from the general consensus of opinion, to be highly likely. These, however, do not attempt to account for the absence of colouration in some cases of constipation, in which nearly all the same organisms (except *bacterium lactis*, *bacterium butyricum* and *oidium albicans*) are present, as are also present in green diarrhœa.

Personally, I am inclined to accept the chemico-bilious theory as the most likely, and answering all conditions under which we find the green colouration, as also the success in treatment based on this explanation.

CHAPTER X.

EXTRANEous FERMENTATIVE ACTIONS IN THE STOMACH AND
INTESTINES.

HAVING considered the normal functions of the infantile digestive organs, and the points of special importance with regard to the functions of the bile, we will now briefly review those processes occurring in the stomach and intestines which may be regarded as apart from strictly normal digestion, and which take place under conditions adverse to the maintenance of the same. The fermentative agents which may be said to produce these results are divisible into two sections.

1. Those whose action is to produce various chemical products of an irritative nature, and which may be spoken of as being chemico-mechanical irritants. Stomach and upper part of small intestine.
2. Those whose action is the production of certain elements which may be regarded as morbidly therapeutic, and may be spoken of as toxic irritants. Small and large intestine.

The first group is chiefly concerned in the manufacture of certain chemical products and gases from articles of food introduced into the stomach.

The second group is concerned in the evolution, from both the food and the secretions, of substances usually associated with the destructive decomposition of proteid material, and which are known as toxic alcohols or ptomaines.

Both of these agents may be introduced by ingesta, or may be gathered from the atmosphere by various means such as the hands or mouth during the ordinary respiratory action.

In conditions of health the normal secretions of the stomach and intestines—as also the bile—are said to be distinctly antagonistic to their action, or, at any rate, to control them to such a

degree as to prevent any excessive accumulation of the products of their activity.

The presence of these products in small proportion is said by some to be more or less necessary as adjuvants to the natural secretions, and it is not till they become excessive that they assume the rôle of pathological factors.

This may easily be the case, from the fact that one of their actions is the splitting of neutral fats with the production of fatty acids; and we also know that the presence of free fatty acid is essential to the emulsification of fats which takes place normally during digestion. It may also be that proteids, and even carbohydrates, are acted on in some analogous manner by those germs commonly regarded as putrefactive, with the production of some more simple and easily assimilable elements from the more complex, accompanied more or less by the formation of those bodies of toxic irritant properties termed ptomaines, present under normal conditions in too small quantity to exert any harmful influence, but, under altered conditions of insufficient control, assume so large a proportion as to become direct agents in the production and maintenance of morbid processes.

We can easily see that any circumstance tending to upset the balance of what is generally known as normal function, condition, and secretion of the various organs, such as congestions from chill, unsuitable dieting in all respects, or the existence of adverse and intrinsic conditions of diminished bodily resistance and ill-health, such as diathesis, may afford the needed opportunity which calls into power the harmful processes attributable to these organisms. Again, it is possible that the action of one set of these organisms can and does afford the needed opportunity for calling into operation the other, and *vice versa*.

One of the constituents, at least, of the gastric juice is said to exercise a marked retarding influence on these agents of fermentation, and that is the hydrochloric acid normally present as a secretion proper of the cells of the gastric mucous membrane.

Bearing in mind the extreme liability which the infantile

stomach has to be adversely influenced both by systemic conditions, and by derangements of other sections of the alimentary tract, we can at once comprehend that such influences, as directly affecting the function of the secretion of the gastric cells, produce an almost total absence or marked diminution of one or other of its normal constituents.

On the other hand, an excess of unsuitable food of high resistance to the action of the gastric juice may exhaust the secretion, or use up its normal constituents; and, by their absence or diminution below a certain proportion, permit the excessive action of those agents whose products, in large proportion, tend to give rise to morbid processes. Taking all the foregoing points, together with the fact that in nearly every case of infantile diarrhoea is to be found the administration of some patent farinaceous infants' food, perhaps in combination with milk in various stages of decomposition and in unsuitable proportions and quantities; or of milk alone, under the same conditions, in a state either of active¹ or incipient fermentation, taken from utensils in an unclean and foul condition; often administered by means of an apparatus (the feeding bottle and tubes) in a state of actual cultivation of those germs associated with the production of the fore-mentioned chemico-mechanical and toxic irritants, and accompanied by more or less cane sugar; it cannot be wondered at, that the existence of what may be called an absolutely simple non-fermentative case of infantile diarrhoea is chiefly conspicuous by its absence.

In fact it is doubtful whether any case is ever purely simple, or, if so, remains in that condition long after the onset of the disease.

At any rate, by the time it reaches the physician it is either active fermentative diarrhoea, with green stools, or the chronic stage of the affection, either accompanied by ulceration or in a condition of secondary infantile cholera, and collapse.

The principal agents included in group 1, spoken of as producing chemico-mechanical irritants are the organisms known

¹ Flügge.

as the bacterium *lactis*, the bacterium *butyricum*, and the *oidium albicans*.

Whether or not the bacterium *butyricum* produces butyric acid directly from lactose, cane sugar, and starch, or from lactic acid (which is previously produced from lactose, cane sugar and starch by bacterium *lactis*), is of small moment.

It is also highly probable, that from experiments carried out that the *oidium albicans* or thrush fungus is able to elaborate one or either acid from lactose, cane sugar, and starch.

Yet there remains the possibility that the thrush fungus acts merely on the gastric mucous membrane, directly or reflexly from the mouth, producing defect in the constitution of gastric juice, lowering of vitality, and providing the opportunity for the action of the other two ferments. There is also a tendency of the fats of infantile food to undergo fermentative action with production of fatty acids.

The generally accepted theory is that the bacterium *lactis* is able to elaborate lactic acid from milk, and that the bacterium *butyricum* then acts on the lactic acid with the production of butyric acid, free hydrogen and carbonic acid gases. The acids act on the mucous membrane of the stomach and cause it to secrete an excess of mucus, in the vain attempt to reduce the hyperacidity. This mucus is either in itself irritating to the stomach, or is altered by the action of these or other organisms, of a fermentative nature, present, and, becoming modified in properties, exerts an acrid influence in its turn.

These conditions tend to produce a condition of catarrh with vasomotor dilatation and tumefaction of the mucous membrane, with tenderness. The membrane is still further irritated by the distensive pressure excited by the evolved gases, and the presence of undigested and decomposing milk curd, acting mechanically and by putrefactive decomposition with production of toxic irritants known as ptomaines.

Here we have a complete picture of the process within the stomach. Gastric digestion is now much diminished or altogether

suspended for want of proper secretions. This state of affairs either culminates in vomiting and ejection of the irritating contents, or, passing through the pylorus, they find their way into the bowel.

The process is checked by coming in contact with the bile and is for a time allayed, to be followed by one or two loose stools of more or less normal colour. More food in the form of milk is at once given to the infant because it has "thrown up the last feed," or in answer to the excessive thirst which this irritative fermentation produces; and the gastric irritation is maintained in its entirety.

Continuous reflex influence on the liver either exhausts its secreting powers, or directly inhibits its secreting mechanism, with consequent diminution of bile in the canal. No doubt the bile ducts partake in the general tumefaction and retard the entry of bile into the canal.

The contents of the stomach, on entering the canal, now meet with little or no action from the bile, and the chemico-mechanical fermentation proceeds, with an increase of putrefactive fermentation in the food and the discharge from the mucosa, the small quantity of bile present becomes reduced with the formation of sulphuretted hydrogen and biliverdin. The excessive mucus in the lower reaches of the bowel then to a great extent neutralises any remaining acid, or it is further decomposed by other organisms, with formation of more carbonic acid and marsh gas, with consequent frothy stools of neutral or alkaline re-action, or they may be of a distinctly acetous re-action and odour, according to circumstances.

This fermentative action, according to its intensity or the resistance of the individual, either passes into a chronic state of green diarrhoea with undigested milk curd in the stools with more or less febrile re-action, or, whether from reflex action or septic absorption, the temperature rapidly rises, the flow from the secretory organs ceases, the motor action is suspended perhaps also by paralytic distension, the retained contents undergo additional fermentation and putrefaction with consequent increased irritation, vaso-dilator action is called in, and marked vaso-motor paralysis supervenes, and

excessive flow into the bowels takes place, with secondary infantile cholera. We now have an alteration in the colour of the stools from the fact that the liver is somewhat relieved by the intestinal flow, and bile begins to find its way into the bowel once again.

The disease now subsides, or in the event of continued defective feeding or other causes of irritation, such as unclean bottles, etc., the liver becomes exhausted, and diminished flow of bile again supervenes, and the green stools with curd return, and the disease runs on to chronic changes in the stomach and bowel wall of a fibro-plastic nature, with subsequent atrophic changes in the mucosa and secretory glands, or ulceration sets in of more or less general intensity. Untreated, the disease continues to progress either to extremely slow and problematic recovery or to a fatal issue. We now have to face the probability of such strictly pathogenic organisms as pyococci (*streptococcus* and *staphylococcus*), or even the organism of diphtheria, gaining access to the ulcerated patches, sometimes producing enlarged mesenteric glands, or, in other cases, a rapid febrile re-action with all the symptoms of general septicæmia. Probably to one or other of these may be due the peritonitis arising during ulceration of the bowels, being simply sero-plastic or suppurative, according to the nature and kind of infection. Again there is the possibility of tubercle bacillus gaining access and affecting the intestine with the occurrence of secondary tubercular enteritis and peritonitis. And in this matter it can often be elicited from the relations of a patient suffering from tubercular disease, which usually occurs after the first year of life, that the child was always subject to attacks of diarrhoea or "looseness of the bowels from birth."

Hence in the prophylaxis of tubercle it is well to bear in mind the need of rapidly correcting derangements of the bowels of infants, as chronic diarrhoea with ulceration of the bowels is undoubtedly one of the prime factors in inducing that disease. There is no doubt that the tubercle bacillus gains access to every alimentary canal, and passes out without finding a lodgment provided the surface be healthy and undenuded.

In group 2 (or the agents for producing toxic irritants), are such organisms as the *bacillus coli communis*, the *bacterium termo*, and others connected with the destructive resolution of proteid material, such as milk curd, meat refuse and the discharges, normal and abnormal, of the alimentary canal. Their products can be understood to be separated from those of the more strictly pathogenic organisms, such as the *pyococci*, etc., having no profound systemic action that can be likened to that of the germs usually associated with suppurative action.¹

Their action is mainly local in character, and their systemic influence is purely subordinate, and is not markedly deleterious till absorbed in large quantity. Fortunately the profound changes induced in the walls of the bowel and the excessive flow of fluid into the lumen lowers the absorbing power of the bowel during the time that their products are most likely to do greatest harm by gaining access to the general circulation. Systemic septic poisoning usually attributed to absorption at this period may really be due to the initial dose, before the flow sets in, and may be sufficient to be directly fatal.

The vitality of these ptomaine-producing organisms is more or less governed by the normal secretions, just as are those which produce the more purely chemical irritants, which they markedly assist during diseased conditions. It must not be supposed that the products of the common bacteria of the bowel have no influence in the infant because there is no apparent ill effect in the adult; for it is quite possible that, as in all things of a toxic nature, infants at first will be susceptible to their influence and only acquire immunity as time goes on. We must also remember that the curd itself, apart from any putrefactive action or other fermentation, acts purely as a foreign body and mechanical irritant on the inflamed and tender mucous membrane.

We may now from the foregoing summarise as follows:—That the organisms of group 1, *bacterium lactis*, *bacterium butyricum*,

¹ There seems however to be no doubt that, under certain circumstances, the *bacillus coli communis* may be distinctly pathogenic.

perhaps *oidium albicans*, act chiefly on sugars, cane and lactose, contained in the whey of milk (and it is well to remember this fact when treating fermentative diarrhoea with whey); on starch and its derivatives, dextrines and dextroses, and on the fats of milk; with the production of lactic, and butyric acids, free hydrogen and carbonic acid gases.

The organisms of group 2. The ptomaine-producing agents are chiefly concerned in the decomposition of proteids, such as milk curd (casein), meat refuse, and discharges from the mucosa; and are *bacterium termo*, *bacillus coli communis*, and others concerned in the destructive action on any dead proteid material. And finally that in most cases of infantile diarrhoea we usually have as the primary agent the members of group 1; and those of group 2 acting a secondary or subordinate part. In constipation on the other hand, we have chiefly the members of group 2, as instanced by its occurrence even under the proved absence of the members of group 1, from jugs, bottles, etc., and their products from the dejecta.

CHAPTER XI.

SANITARY SURROUNDINGS OF INFANTILE FEEDING IN HEALTH
AND DISEASE.

IN this department we have to consider the sources and conditions of the milk supply from its origin till it reaches the door of the consumer, and then, from that time, the conditions under which it exists till it reaches the infant, and the conditions and form of the utensils and apparatus from which the infant takes its daily and hourly supply.

The first part of the enquiry is often very much out of the control of the friends and medical attendant of an infant. Yet, as it greatly concerns the ultimate well-being of humanity, it is as well to briefly discuss the situation.

Inasmuch as we are unable to control these influences individually, it becomes more and more an absolute duty and responsibility on those in charge of the public health, that they fully recognise the same and leave no stone unturned whereby danger from that department under their control may be reduced to the lowest possible probability.

Firstly, it is preferable that milk should be derived from cows which are constantly living in the open air and obtaining their food under fairly normal and healthy conditions. For this reason the milk from a country district, where adequate and skilful supervision is exercised, is preferable to milk derived from cows kept in confinement and fed more or less artificially and unnaturally. This is clearly shown by the increased richness in cream and the higher specific gravity of the country-fed cows' milk, as well as its ability for keeping longer, than that of the town-fed, stall-kept article.

Each farmer or keeper of cows, whether meadow or stall-fed, should hold a Government license to sell milk, and should be

subject to forfeiture on proved breach of regulations. No one may sell milk, subject to a heavy penalty, without such a license.

Every cow, kept by such licensee, shall be periodically examined by a qualified official as to its freedom from tuberculosis, pleuro-pneumonia, etc. Each cow, for identification, should be branded on the horn by the same official with a Government mark, and number, and to forge this should incur a heavy penalty. No condemned cow should be permitted to remain in the milk purveyor's possession more than twenty-four hours, and to retain one should render the holder liable to a penalty.

Each cow should be cleaned and groomed periodically in order to keep the coat free from vermin, etc. The udders should be washed before every milking, the hands of the milker likewise.

The source of the water supply should be free from suspicion, both that used as drink for the cattle and that used for cleansing and other purposes (adulteration?). It should be in sufficient force and quantity to adequately perform any flushing operations. And several other minor details which would occur to a trained mind.

In the case of stall-fed cows, a certain amount of green fresh food should be insisted on. The floor of the stable should be of a jointless nature, preferably cement granolithic pavement. It should have an adequate fall to a gutter, which should lead outside the stall to some distance, before falling into any gully trap or drain, and none should be permitted in a stable. The gutter to have at its upper end a hydrant of sufficient power to efficiently flood the same.

All refuse and manure to be at once removed to a distance from stall and dairy, as well as the use of some disinfectant as chloride of lime or creolin. The stable to be well ventilated and have plenty of sunlight. The walls to be of glazed material and the joints adequately sealed. The roofs of stables and dairies to have a regulation amount of skylight surface measurement to permit the entry of adequate sunlight, which is absolutely the

best disinfectant known. This should be in addition to efficient window accommodation.

The whole place to be regularly flushed out by a hose—walls, floor, iron partitions, and mangers—and then disinfected. All brick buildings to be regularly and frequently lime washed.

All milk to be received in receptacles which can be at once closed, and removed from the stable. No milk should be allowed to stand in open pans in a dairy or creamery. All milk receptacles to be so constructed as to permit of adequate scouring, and to be subject to a stream of super-heated steam at least once or twice a week, either by the owner or at an adequate dépôt convenient for a number of keepers of cows over a certain area, *e.g.*, at the local fire station.

All transport and stock cans, for sale of milk, to be only a certain height, so as to allow the arm to reach to the bottom comfortably.

An ideal can is one of a certain height, with a dome-shaped bottom concave internally, and with a wide angle of junction of bottom and sides; it should be capable of being tightly closed and should have an opening in the lid as well as the usual tap at the bottom, in order to permit the passage and adequate action of a stream of super-heated steam.

A deep iron rim round the outside, at the bottom, to permit of the can standing erect.

All milk cans in towns should be subjected to steaming once a day.

This shape will permit of the insertion of a perfectly fitting and close-fibred Turk's head brush, having bristles well down the shank, capable of being driven by machinery at a high rate of speed in order to remove any coagulated material.

All the joints of the can should be soldered over flush.

The turk's head to be frequently subject to scouring and the action of super-heated steam, or should be boiled.

All taps to be easily taken to pieces and cleaned.

All creaming cans to be kept constantly covered, or, what is

better, by means of a glass cover be rendered accessible to the action of light, and to preclude the access of the innumerable flies usually found in dairies, as it is to their agency is mainly due most of the infection by organisms.

All the attendants in a stable or retail dairy to have a clear domestic and personal sanitary bill of health. No *consumptive* to be permitted to work in either establishment.

No retail stock can ever to be opened in the street under a penalty. Delivery cans to be much the same as stock cans though smaller, and, if possible, to be sealed at the dairy and only opened by the consumer. These cans, on account of their extreme liability to infection in consumers' houses, to be specially looked after. The sale of stale milk to be prohibited.

Retail dairies to be constructed of glazed material, and the floors jointless, and to have an open flushable gutter or drain which shall only empty into a gully-trap outside and at a fair distance from the dairy, and to possess ample window accommodation. No dairy should communicate with a dwelling-house anywhere. These are just a few regulations of essential importance.

Many of these regulations might tend to drive the milk trade out of the hands of small and impecunious people and into the hands of capitalists and companies. So much the better for the safety of the public, who sadly need protection. Some persons would advise the sterilization of milk immediately it is drawn from the cow or at the dairy from which it is retailed. This is somewhat superfluous seeing that after it reaches the consumer it will be again exposed to infection. The process also changes the taste of the milk, and is objected to by many persons on that account; besides, that intended for use by an infant can easily be disinfected by sterilization or boiling by the consumer.

CONDITIONS OF MILK ON REACHING CONSUMER TILL IT IS
INGESTED BY THE INFANT.

This section leads us to consider the methods adopted on

MASSILLI MILK

receiving milk from the dairyman till it finds its way into the infant's bottle. In many cases milk for the use of the nursery is delivered in special cans, and should be so in all cases, and from the fact that these cans are or could be made specially aseptic by the better class of milk purveyors, it might be as well that the milk contained be kept in these cans during the whole time that it is being used. The empty can should then be returned to be sterilized and replaced by a sealed full one, and so on. That these cans are provided with a cover is of some importance.

The perhaps ideal method of delivering milk is undoubtedly in glass bottles, hermetically sealed, and returnable to the issuing dairy for sterilization and refilling. This would no doubt be found to be a great assistance to the delivery of pure, aseptic milk, as far as that can go, and might with advantage be generally adopted in the best interests of customers and patients alike. The bottle should be of the "wide-mouthed" variety, screw topped, and vulcanised rubber washers for the cap in place of cork, which is very liable to become foul.

Among the poorer classes, and in certain districts, the milk is on the other hand taken from the dairyman and poured directly into a narrow-mouthed jug with a square bottom, and with a sharp angle at junction of bottom and sides. The hand cannot reach this angle during the process of scouring, which is frequently only a rinse with cold water or at most a so-called "scald," which is insufficient and of too short duration to permit of the total destruction of all fermentative germs. The result is that the interior of this jug is frequently coated at the sides and angle by a deposit of decaying "milk-must" teeming with organisms. This jug is usually the stock jug, besides which there are smaller jugs or mugs, still more difficult to clean, in a like condition of germ cultivation, one or other of which is affectionately regarded as "baby's jug."

The stock jug and "baby's jug" are, from force of circumstances, and the peculiar construction of the houses, often kept in the back kitchen or scullery on a shelf over a stone slop-sink,

in a more or less filthy condition ; or may at times be found standing on the sink stone "for the sake of coolness," in order to keep it from "going bad." There is to this scullery, frequently, a window, opening just over or quite near to an ash pit on which is every possible conceivable decaying matter. Perhaps, also, there may be an insanitary water closet within a very few yards.

Again, while the stock-jug may be kept in the scullery, "baby's jug," or both, may be found in the living room or bedroom; frequently under the bed "to keep it out of harm's way."

In cases of infantile diarrhoea, which prove obstinate, even after the medical attendant has inspected the bottle and annexes, and baby's jug, and found them satisfactory according to his directions, the prime offender will be found to be the receiving or "stock-jug," which perhaps has been overlooked through its existence not being suspected.

The difficulty of the jugs can be overcome by directing that all milk intended for an infant should be received in a basin with a spout at one side, having a semi-circular cross-section as being easy to keep clean, and, if possible with a cover, both preferably of glass. If that cannot be obtained or gets broken, then point out the efficacy of an ordinary plate, and insist on the milk being always covered when in the house.

As to the place where the milk is to be kept, if a convenient hanging cupboard, preferably varnished inside, be unobtainable in a nice situation, for want of a better place, I direct the milk to be kept covered on a shelf under the staircase; permit nothing else to be kept there; have it lined with varnished wood in order to prevent dust and dirt from falling during use of the stairs; or if this cannot be done, then frequently lime washed.

These may seem tedious and trivial details, but are absolutely necessary to success. In this respect the occasional use of perman-ganate of potash, which will only stain unclean vessels, or a little chloride of lime applied as an antiseptic to the basins will be found of great service.

This now brings us to consider the problem of the pureness of

milk from a septic standpoint. From a highly scientific point of view, and on grounds of great exactitude, too much cannot be said in praise of the sterilization of milk in use by an infant. Wherever possible, by reason of the efficiency and intelligence of the attendants, this should always be resorted to as the best procedure.

Of the many patterns of milk sterilizers now on the market perhaps the best, as answering the demands of cheapness, simplicity, usefulness, and thoroughness in its action in respect to rapidity, effective sterilization, and requiring little or no technical knowledge and special skill, is the pattern known as Aymard's Patent Milk Sterilizer. Any one familiar with the drawbacks and difficulties to be met with in applying the procedure of feeding with sterilized milk will at once appreciate the excellence of this simple and effective little apparatus. The apparatus known as Soxhlet's is also useful; yet care should be taken to prevent the fatty matter of the milk adhering to the bottles, and also to see that cold milk be not given to an infant by careless persons; and to have the many bottles frequently cleaned, which is by no means the least important matter.

Where the means of the patients, or their trustworthiness for fully and accurately carrying out the process render its employment doubtful, it can be dispensed with, and an analogous procedure employed which answers the purpose equally well. As the main essential of sterilization is the raising of the temperature of the milk by direct heating or by the agency of steam, this can be adequately imitated by less troublesome means.

Keeping sterilized milk in flasks on ice, etc., and the large armamentarium of feeding bottles needed are frequently far beyond the means and circumstances of the patients. Further, the great argument that the whole of the twenty-four hours' supply can be done at once, frequently conduces to a serious drawback, as it often lends itself to laziness and neglect, and ends in the infant often obtaining a "cold milk" feed at the hands of a careless nurse or mother. This, as everyone knows, is provocative of derangement in gastric digestion.

Further, I have seen sterilized milk put back into jugs and basins on the sly with all consequent results, as the lay mind frequently cannot see why milk that has been sterilized can ever again become "sour," and in spite of the most earnest and stringent directions, some dereliction of duty often occurs and throws out one's calculations.

It is therefore better to devise some generally easy and simple method which will at the same time meet the demands of science and practical exactitude in utility. All milk should be directed to be at once boiled on receipt from the dairyman. The temperature can be raised above boiling point and kept there without the milk boiling over, as most cooks know, by constantly stirring during the process. The milk is thereby rendered approximately sterile,¹ or sufficiently so as to render it comparatively safe; it is also now lighter, and less firm in clotting. The milk is then returned to a clean stock basin and kept constantly covered in a suitable place other than the scullery or living rooms. As the meals are wanted, they are taken from the stock basin, diluted down to the proper proportions with boiling water, the mixture raised to boiling point, cooled down, and immediately given to the infant.

The author is aware that certain authorities object to boiling or sterilizing milk as it tends to render the milk indigestible, which is most certainly not the case in his experience; and that milk so treated tends to produce scurvy rickets, which might also be applicable to other cooked food, and may easily be due to the poorness of the milk primarily, having been drawn from a weakly and anæmic cow, as when kept for a length of time in a stable or byre in a town.

Any remaining after a feed is directed to be thrown away, and on no account allowed to be returned to the "stock basin." The bottle is to be at once washed out and no milk residue must ever be allowed to stand in it.

¹ Flügge.

In the use of malt extract, or ground malt for sweetening or digestive purposes, as previously advised, it is well to bear in mind and impress upon the attendants that, if the malt be put into the mixture before it is heated, it will, on the rise of temperature, at once cause the milk to "curdle"; therefore it should be added when the mixture is cooled down by immersing the bottle in cold water, which rapidly reduces the temperature of the milk. If the bottle be moved about when in the water the cooling is rapid. The malt and milk mixture should at once be administered.

The use of malt, besides being valuable as a digestive, acts as a deterrent on laziness; as a quantity of food cannot be made and stood on one side to become septic, for the reason that it is often upset by the diastatic action of the malt on the milk. By this method we also ensure the infant obtaining its food at or near the correct temperature.

There are, of course, certain malted foods which can also be used in this manner (*See Appendix*).

The peptonising and pancreatising of milk before use are also of high scientific and practical value as aids to easy digestion in ailing infants; but, for the reason that these procedures often lead in ignorant hands to the serious contamination of milk, they should be guardedly used under strict supervision, if trained attendance cannot be obtained.

In serious cases of illness calling for prompt measures, the absence of all these processes need not hinder us from carrying out efficient treatment, for reasons which we already know; in fact the treatment is mainly a negative one in most cases.

At the commencement of acute cases, or at the beginning of protective treatment in chronic cases, etc., it is as well to withhold all milk or its derivatives, and in this respect the administration of whey, lactose, and cream might be condemned as providing the very elements on which fermentative germs already in the stomach and intestine can have full power. The short necessary deprivation of lactic nutriment, whilst precautions are taken to remove and destroy these agents, need not seriously affect the ultimate welfare

of a patient; indeed, it is often for the best. Consequently we have plenty of time in which to look round, and carefully instruct in the preparation of these foods when an improved condition of health may permit their administration.

As an example of misapplied zeal the following will prove interesting:—An infant who had been suffering from green diarrhoea, with alternating constipation, was brought for treatment. It had been ill for three and a half months, and was a veritable skeleton in a skin. The mother, according to directions, had been using one pint of sherry per diem in the preparation of whey, in combination with a specific amount of milk sugar and cream. These were promptly and absolutely forbidden. The infant was put upon plain non-coagulable albuminous diet with pepsine administered by the mouth, plenty of water when it desired it, a fair quantity of stimulant, and the fermentative action which was being promoted by the whey and milk sugar was corrected by resorcin and attention to the bile production, with prompt and permanent improvement.

Formulæ for peptonising, pancreatising, etc., can easily be obtained by reference to any text-book on the subject of diet.

None of the already too-numerous recipes or formulæ as to the ingredients and quantities are here given, for the reason that a due regard to all that has been said will enable a trained mind to select a suitable dietary, and, as cases differ somewhat, modifications can then be introduced. Sufficient has been said to indicate the lines on which to work, and the rest ought by now to be comparatively easy. These matters are also thoroughly and exhaustively dealt with in educative text-books.

As to the question of domestic sterilization of milk in order to destroy germs and spores of such diseases as tubercle, etc., it is problematical whether the process is ever sufficient. Careful attention to the source of milk supply, and the means of conveyance of the milk to the consumer, and the care which is bestowed on it after that, up to the time it is actually used as food, ought as far as possible to obviate their occurrence and

do away with the necessity of leaning too much on domestic sterilization, which is in most cases but a broken reed for these purposes.

FEEDING BOTTLES AND THEIR ANNEXES.

We have now to consider the special apparatus from which the infant directly derives its nutriment.

There is no more important necessary item in the successful feeding and care of the healthy or ailing hand-fed infant than strict attention to the condition of the bottles and their appendages. The increased necessity for extra care under conditions of serious ill-health becomes a vital factor in the successful treatment of all alimentary affections, owing their origin and maintenance to infection from food, and from utensils in contract with the infant, or usually containing such food.

In the vast majority of such cases the origin can invariably be traced either to the bottle and appendages, or to the utensils used to contain and prepare nourishment. The reason for this, as everyone knows, is the great tendency for the adherence of a deposit chiefly derived from the milk to the surfaces and interstices of these articles. This deposit is usually in a more or less advanced stage of decomposition, and teems with organisms; putrefactive, and those which produce the strictly chemical resolution of milk. To attempt to treat a case of sepsis of the infantile canal with the most advanced and improved methods of feeding and internal medication, and neglect to observe due cleanliness in feeding apparatus and utensils, or bestow only a cursory inspection upon them, is simply to court disaster, and at best an unnecessary prolongation of the disease.

It is well to bear in mind, and to firmly impress upon the attendants, that utensils absolutely clean, chemically and aseptically, may become intensely infective at the end of twenty-four hours; and with regard to this, it is absolutely incumbent on the medical attendant that he personally inspect the condition of these

articles on every visit, make suggestions according to circumstances, and, if necessary, not to scruple to carry out with his own hands a thorough cleansing and disinfection for the sake of the educative influence such a procedure will have on the inexperienced and ignorant.

We will now consider the formation of the bottles and their appendages as regards liability to become infected, and the facility or otherwise with which they can be cleansed. The common and popular shape of feeding-bottle is that approaching the shape of a cognac flask, stouter, and bent antero-posteriorly at the shoulder upon itself. It is provided with a flat surface in order to permit of its standing, which gives to the interior a sharp corner or angle at the junction of the flat bottom and sides. The peculiar curve forward of the neck presents a difficulty in the manipulation of the brush, and the angles of the shoulders are also too abrupt, and prevent an adequate application of the same.

With a little care the male and female screw of the neck ought to be kept fairly clean. With regard to the tubes, too forcible and too extravagant terms of honest and heartfelt condemnation cannot well be used. The glass tube portion is invariably coated, if not externally then internally, with a layer of decomposing "must." If this is tolerably clean, the junction of the glass and india-rubber, for the reason that they are seldom separated, is usually to be found in a like septic condition. As regards the indiarubber tube, which is the first and foremost offender of all, words are not yet coined with which to describe its lethal functions. As a rule it is seldom, if ever, clean. In conjunction with the glass tube, teat, and screw, it is laid aside; the "bottle is rinsed" or "washed," and the appendages replaced in their pristine condition of infectivity.

If the small brush provided for the rubber tube is used, the force necessary for pulling it through usually cracks the rubber transversely. In these cracks lurk all the organisms necessary for fermentative conditions of the Alimentary Canal, and escape all subsequent cleanings. Boiling might be of service, but that

requires a rubber which will stand a high temperature and yet remain serviceable and flexible. This is hard to obtain, and even then one is not sure that it will be carried out. Lastly, the teat should invariably be closely inspected.

The instrument, affectionately called "comforter" or "soother" should be duly sought out and, if permissible, at once consigned to the fire; if not, then frequently and thoroughly disinfected. This is by no means a trivial precaution, as will be found in the treatment of a case infected by thrush.

Finally, take care to have dribbling bibs, frocks and jackets which have become wet and soiled from milk, saliva, or vomit, removed as often as possible. A fouled bib in constant use will be found most efficacious in keeping up a case of thrush or fermentative diarrhoea.

After a careful investigation of every possible existing shape of bottle, with due regard to its utility and cleansible properties, I seriously question whether a more suitable pattern can be obtained than that having the shape of a lengthened ovoid, the interior of which presents a series of easy curves and no angles. Its end is specially shaped to permit the accurate fitting of the cleaning brush. It is provided with a screw stopper and red rubber washer, so arranged as to permit the entrance of air to facilitate and regulate the suction of its contents. It should, of course, have no tube. These bottles should have no stoppered opening at the side on any account, as it permits a too free entry of air laden with dust and germs, and, besides, the cork of the stopper itself is frequently and almost constantly in a highly septic condition. A bottle, answering the above, is manufactured by Messrs. Maw, Son & Thompson. This pattern specially lends itself to perfect and adequate cleansing or boiling, and also for the process to be hereafter described.

Patterns of feeding-bottles open at both ends, based on the idea of a through stream of tap-water for cleansing, are subject to the following disadvantages:—They are liable to leak at the dependent end. There is increased probability and risk of fracture at one or other screw ends. There are also two screws

to clean, and one is certain to be neglected. It specially lends itself to infection of an infant, from the fact that lazy and ignorant persons will content themselves with merely running a stream of water through the bottle, which does not remove any adherent greasy albumin ; they will neglect to scour and scrub the interior, with the result that under the best conditions, though apparently and tolerably clean from the lay point of view, it might actually be highly and intensely infective at all times.

It is quite unnecessary to dilate on the advantages of the absence of tubes and the direct application of the nipple to the passage in the screw stopper. The complaint frequently advanced that such a bottle entails extra care and attention during feeding, can be safely ignored ; firstly, because too much care cannot be bestowed on an infant in these matters, and secondly, the inventive genius of the lazy usually contrives to fix and prop the bottle so that the infant lying in its cot can obtain its food just as easily as from a bottle with its death-dealing tube.

As regards the cleaning of the bottle and its appendages, the following points are of interest :—All bottles and screws should be subjected to periodical scouring with soda and soap with a brush for the removal of grease, certainly once a day. It is well to remember that every meal leaves a thin deposit of grease on the surface of the bottle. This serves for the further attachment of an albuminous layer. In many cases, and especially in those in which lime water is added to milk for various reasons, this grease deposit after slight fatty acid fermentation forms an insoluble calcium soap from either the natural lime salts of the milk, chemically altered by decomposition, or from the lime water artificially added as already mentioned. This soap is firmly adherent and frequently defies the efforts of hot water, soap and a brush. It is also probable that this soap from its deficiency of alkali has a very slight, if any, deterrent influence on fermentative processes. It has then, in conjunction with any adherent albumen, a splendid opportunity of becoming a cultivative medium for any and every organism concerned in the origin and maintenance of those diseases under

consideration. After the use of soap and a brush on this deposit, there frequently remain streaks of this substance which escape, and must be removed.

After careful experimentation I find that there is nothing which imparts to the surface of glass so clear and brilliant a cleanliness as the use of fine sand, sandy soil or fine grade shot. Of the three, sand and sandy soil are preferable, as they are splendid adjuvants to the brush, and mixed among the bristles are first-class cleansers of the screw complements.

If a Maw's bottle be one-third filled with sand, and half filled with hot water, the mouth stopped by the hand, and the bottle violently agitated for a few moments, the glass will, on rinsing out the sand, be found to be chemically and aseptically clean to all practical purposes.

If wetted sand be introduced into the nipple, and the nipple taken between the forefinger and thumb, and the whole triturated by a to-and-fro movement, on washing out the sand the nipple will be adequately cleansed. This process should be applied every morning to bottle, screw, and nipple.

After cleaning by a brush with soap and soda in hot water, and the use of sand if deemed necessary, they should be kept immersed in a solution of permanganate of potash (one saltspoonful to the gallon of water), in a basin set aside for this purpose. Any other mild antiseptic such as boracic acid will suffice. Personally I prefer the solution of the permanganate of potash, for the following important reason:—

If an apparently clean bottle be suspected, take a saltspoonful of the permanganate, put it in the empty suspected bottle, add one ounce of water, and manipulate it so that the fluid covers the whole surface of the glass. Permit this to remain for one or two minutes, and then wash out freely with pure tap water. Now take the suspected bottle into a stream of transmitted sunlight; holding it up, gently and slowly manœuvre the bottle so as to catch with the eye the glint from its surfaces. If the bottle be ever so imperceptibly unclean before the use of the solution of

the permanganate, a dull, red-brown scintillation, hardly perceptible, will be seen on minute and practised observation. If this be present the bottle is inadequately cleaned, and a free application of more sand with the brush will remove all liability to stain from the fluid. If the glass be chemically clean no quantity of strong, fluid, permanganate of potash, stood for any length of time, will produce this red-brown glint.

In cases where there is any suspicion of deceit or untruth as to proper cleansing of bottles on the part of nurse or guardian, this simple yet reliable test will at once settle the question, will permit of a definite statement from the physician and will inspire a respectful awe for powers of mysterious divination on his part. There is, consequently, no safer, surer, or more exact test as to cleanliness of a feeding bottle than the use of a strong solution of the permanganate of potash, in the manner described above.

After every feed the bottle should be rinsed free of residual milk and replaced in the antiseptic fluid, to be removed and again rinsed before using. Milk remaining in a bottle after feeding an infant, should on no account be permitted to stand in that bottle, nor should it be returned to the sterilized stock, as it is unsafe owing to the bubbling of air through it during suction, and the injection of saliva by the infant. This is of obvious importance in cases of thrush. All residual milk should be promptly thrown away.

It is as well that the medical attendant should spend a little trouble and time in order to briefly and clearly explain the rationale of the keeping of utensils and bottles, etc., aseptically clean. By doing this, one will avoid giving offence from any suspected or conveyed implication of "dirtiness," to which patients are so sensitive. Besides, by careful explanation one will frequently convert a careless person into an antiseptic enthusiast.

It will be found a great help to the general practitioner if there be printed on a card a few points of importance in the care of the food for the infant and its bottle, and the same handed to the guardian of the child for future reference and guidance. A scheme of such a card is appended.

HAND-FED INFANTS.

A FEW VALUABLE HINTS TO RENDER THE ARTIFICIAL FEEDING
OF INFANTS MORE SUCCESSFUL.

To keep milk pure and free from disease germs:—

1. *Disinfect*, by boiling all milk intended for use of infants directly it be received from the milkman, and before using.
2. *Keep clean*.—Never at any time put milk into a jug, but into a milk basin, and always keep it covered with a clean plate.
3. *Avoid contamination*.—Never keep milk for use in a back kitchen or scullery, but in a cool, clean, place. Never permit refuse milk to stand in an infant's bottle. Do not return it to the milk basin, but throw it away at once.

Remember that nothing is so easily infected as milk, and milk that seems pure can easily be virulent poison to an infant.

Bottles and tubes.—These, if ever so slightly foul, are frequently the cause of diarrhoea and death. Bottles with tubes should never be used.

No amount of simple washing will keep a bottle and tube clean and free from disease germs for any length of time.

Adopt the following plan:—Use a brush. Half fill the bottle with fine, clean sand and a little water, and then shake up violently for a few minutes, when the bottle will be brilliantly clean. Pay special attention to the screw. Then immerse bottle, stopper, and nipple in a solution of permanganate of potash in a large basin (one saltspoonful to a gallon of water), and leave them there till required, then rinse thoroughly and use, afterwards clean with sand again, and replace in the permanganate of potash solution till required, and so on. Carefully clean and disinfect the nipple.

Reliable test of cleanliness.—If the bottle be thoroughly clean and free from decomposing and sour "milk must," the glass will not be stained by the permanganate of potash solution. If it be ever so slightly foul there will be a red brown stain on the glass, indicating more sand.

SEPTIC CONDITIONS OF THE

CHAPTER XII.

GASTRIC AND INTESTINAL ANTISEPTIC DRUGS.

UNDER this department, in the treatment of Infantile diarrhoea and constipation, come those aids which may be classed as extraneous and artificial.

It is not to these, used solely and alone, that we must look for successful treatment, but to their use in combination with other modes of procedure according to circumstances. Further, it is better to have an approximately correct and comprehensive knowledge of the modes of action of a few of these agents, from constant practice in their use, than a somewhat vague and hazy acquaintance of a vast armamentarium, applied from time to time in a haphazard manner, merely because such and such a drug has an antiseptic action somewhere or other in the alimentary canal. In this respect, it is necessary to have, as far as possible, a well-defined knowledge of the uses and spheres of action of the various drugs, as uncertainty in these respects is prolific of failure and ultimate discouragement.

It here becomes necessary to point out the need for separating these drugs into gastric and intestinal antiseptics, and to further divide them into the soluble and insoluble, and into the immediately and remotely toxic.

To the drugs usually understood as being direct intestinal antiseptics, by reason of their intrinsic direct action on the organisms within the canal, should be added those drugs which indirectly conduce to a condition of asepsis, by reason of the influence they exert on the conditions, secretions and functions of the several parts of the alimentary system, in that by so doing, they necessarily retard and render difficult the free and prolonged action of fermentative organisms. The chief direct antiseptic drugs are:—

Resorcin, carbolic acid, salicylate of quinine, salicylate of soda, hydrochloric acid, and perchloride of mercury.

The above are all either directly soluble in water, and as such produce a bactericidal action, or are soluble after being acted on by the juice of the stomach.

These may also be called direct stomachic antiseptics, in that their beneficent action is chiefly or entirely exerted on the contents of the stomach, and that they are either used up and destroyed within that organ or are taken up into the circulation directly from it, and do not survive to be able to play any important part in the intestine.

Resorcin, from its being a crystalloid substance, rapidly leaves the stomach and enters the circulation. It is powerfully antiseptic in the stomach; a solution of 0·5 per cent. possessing a marked retarding influence on gastric fermentation. It is the least poisonous of the benzol series. It is quite safe, under fifteen grains, when administered to the youngest infant.

It should be administered as a solution made from powders as wanted, from two to four grains for the youngest infants up to three months old, every four hours, and an increase of one grain for every month till six months old, and then six grains till one year, and so on till the maximum of from ten to fifteen grains be given to a child, from two to six years old, *pro rata*.

It is most valuable in early cases, and in cases of acute catarrh of the stomach before the disease advances so far as to involve the intestine.

It is absolutely non-irritating.

In chronic cases its use is at once followed by improvement.

It should be continued for a little while after the diarrhoea has ceased, in order to check septic processes causing constipation. Most cases under its use should terminate favourably from a week to ten days at the outside. Its use need not be absolutely continuous, for after the case has begun to improve, it can be eased off; and only an occasional dose be given during convalescence and the constipatory stage of recovery.

This drug is, so far, the best we have for the treatment of fermentative changes in the stomach, and indirectly, in the intestine.

Salicylate of soda, is perhaps after resorcin, the next most useful drug in preventing gastric fermentation.

It can be administered, in from two to four grain doses, every four hours to an infant.

It is compatible with alkaline carbonates. It acts directly in the stomach, and has a further not unimportant function which must be borne in mind.

It is a direct hepatic stimulant, at the same time rendering the bile more fluid.

This last item in its action is of clear value in the treatment of septic conditions.

Carbolic Acid.—This drug is at the same time a friend and an enemy.

It is useful in isolated doses, as in thrush, or early cases of excessive fermentation in the stomach.

Half to one minim doses, well diluted, are all that should be given to a young child or infant at a time: in a limited series of doses, say four. Its use should not be continued for long; and it is well to remember, that, like opium, certain individuals are very susceptible to its action. It is serviceable as a mouth wash in thrush, applied as a lotion on a piece of lint.

In cases that have been ill for long, and are somewhat exhausted, carbolic acid should be generally avoided, as it has the power of producing profound toxic action long before pyro-catechin makes its appearance in the urine.

On drowsiness, with upturned eyes, making its appearance in a case of chronic diarrhoea under carbolic acid, its use should be at once stopped, and a plain alkaline diuretic at once administered, with stimulants.

Salicylate of Quinine.—This is not very bitter, and can be given in from two to three-grain doses in sweet emulsion. It is of great service in fermentative diarrhoea in infants in malarial climates,

and, combined with the salicylate of bismuth, it is very useful in cases of typhoid fever in older children.

Hydrochloric Acid.—It is reputed to have a marked deterrent action on fermentative processes in the stomach. Especially is it preventive of lactic and butyric fermentation, yet, like all mineral acids, must be regarded as outside any practical utility in this disease. It excites to increased secretion of mucus besides its coagulative action on cell protoplasm. Its artificial administration is therefore contra-indicated.

The only aid we can derive from it is when it is physiologically secreted by the stomach in proper proportion, and when the gastric mucous membrane is able to do this it does not need much assistance.

This secretion is rapidly brought about by the action of other antiseptics, and the peculiar action of pepsin administered artificially by the mouth. In convalescent cases, hydrochloric acid can be given as an aid to digestive action, and also to those cases, after prolonged diarrhoea, which suffer from marked persistent weakness of digestive power, with atony.

Perchloride of Mercury.—This drug is much extolled by some as having a direct action as an antiseptic. If present in sufficient quantity to act as such, it is a powerful irritant poison. I have seen some most undesirable results from its use.

The probable reason for its being of benefit is that it stimulates the liver to action and thus retards fermentation in the intestine. Personally, I never use the drug, and have no cause to miss it.

Calomel.—On the other hand, calomel is a great help. It may act directly as an antiseptic by reason of some of it being converted into the perchloride. But here even this is open to question, and perhaps its real sphere of action is again an increased flow of bile with consequent benefits. Given in a fraction of a grain, from one-sixth to one-twelfth, every four hours, till from one to two grains have been taken, it exerts a markedly beneficial action.

We now come to the consideration of those directly antiseptic drugs, which owing, to their insolubility, are unaltered in the

stomach, and pass on into the intestine, where, owing to a dialytic action of the secretions there met with, they are decomposed into two or more derivatives, and which are there directly antiseptic on the contents of the bowel. These can be called intestinal antiseptic drugs, and are:—*Salicylate of bismuth*, *benzol-naphthol*, *salol*, *naphthalin*, *iodoform*, *naphthol*, and certain others of the aromatic series.

Of these undoubtedly the most valuable are *salicylate of bismuth*, *benzol-naphthol*, and *salol*.

Naphthalin and *naphthol*, are, owing to certain physical properties, unpleasant to the patient and attendants, and are more toxic than the others, the former being contra-indicated in the presence of any liability to kidney and vesical complications; as is also *benzol-naphthol*, though less toxic and more pleasant to take.

Iodoform, has a depressing action on the central and circulatory system, and any iodine set free in the bowel may, as iodine sometimes does, give rise to acute irritative symptoms.

We are then well advised to consider, and pin our faith to, the first three.

Salicylate of bismuth, is the most pleasant of all, as it is a tasteless powder, which breaks up into the sulphide of bismuth and salicylic acid.

The bismuth salt is mildly astringent, and deterrent on the secretion of mucus. The salicylic acid is directly antiseptic. It (*salicylate of bismuth*) may be given to an infant in doses of from one to five grains till one year, and after that from five to ten grains up to five or six years *pro rata*.

In the use of the drug, care should be taken to warn the attendants of the blackening of the faeces, otherwise they may attribute this to an aggravation of the disease, and accuse the medical attendant of making the case worse. An awkward occurrence for a young beginner! It is practically non-poisonous, and all things considered, is perhaps one of the best drugs we possess in the treatment of septic conditions of the infantile stomach and intestine. It is particularly indicated in cases of ulceration high

up or low down in the bowel; also in cases of exfoliative dysentery, and in typhoid fever and tubercular ulceration.

Benzol-naphthol, is non-poisonous in reduced doses, and can be given in from two to five-grain doses, in powders, administered as wanted in sweet emulsion, every four hours, to infants up to one year old, and from four to eight grains up to three years *pro rata*. In cases of kidney irritation it must be guardedly used, as it is excreted as hippurate, and the increased acidity of the urine is undesirable in those cases.

Salol, is split up in the intestine into phenol and salicylic acid, which are both of them direct antiseptics.

There is the further action of the phenol as an anodyne sedative to the nervous and motor irritability of the intestine.

This drug, like carbolic acid, must be given with great care, but is less toxic, is tasteless and odourless, and can be given in combination with ammonia and alkalies in a suitable emulsion. For an infant from half to one grain every four hours till three months old, from one to two grains till one year old, and then from two to three grains after that till three years of age, *pro rata*. From its double action, and less poisonous properties than carbolic acid, it is, next to the salicylate of bismuth, the best remedial antiseptic agent we possess. Small doses of salol are of service in constipation and in cases of *tabes mesenterica*, and enlarged spleen, suffering from marked alimentary sepsis.

Standing half-way between the gastric antiseptics and the intestinal antiseptics are the *subchloride of mercury*, *grey powder*, *podophyllin*, one-twenty-fourth of a grain, *iridin*, one-twelfth of a grain, etc.

These drugs are undoubtedly of antiseptic value from their action in increasing the amount of bile finding its way into the intestine, and there controlling all fermentative processes.

The vegetable hepatic stimulants are indicated more in the cases of young children, and children suffering from those septic conditions arising in the bowel, being due either to excessive absorption of diminished bile or defective supply, usually met with

in cases of tabes mesenterica, tubercular ulceration, enlarged spleens and so-called cases of simple atrophy, in all of which the use of mercurials is contra-indicated and directly harmful as being blood destroyers.

Let it be clearly understood that anything like a purgative use of any of these drugs is absolutely harmful, and their use to such an extent is foreign to the purpose of this method of treatment, and is a grave error of interpretation.

On the slightest indication that any such action is being brought about, their use should be at once reduced, to be resumed again when relapsing conditions render them necessary.

Their use should only extend to a change in characters of the dejecta; as to odour, colour, and general consistency, taking care to carefully ascertain the frequency with which the bowel rejects its contents: and this should be controlled by regulating the amount of these drugs given, and the condition and suitability of food, as also the power of gastric digestion, rather than by the use of drugs, such as opium, having a known influence on the system, and which are most likely to lead to error and harm.

Before leaving the subject of drugs, it would be as well to consider those more important drugs, having no direct antiseptic value, but which, by reason of their beneficent therapeutic action in improving the functions and condition of the stomach, tend to diminish any liability to fermentative action.

These are *pepsin*, *bismuth* (preferably the solution of the ammonia citrate of bismuth) *chloride of ammonium*, *alkaline bicarbonates*, *hydrochloric acid*, and *nux vomica*.

Pepsin.—This extractive of gastric juice is one of the most valuable possible of all drugs in the treatment of the tract in children, and indeed in adults.

Quite apart from its common use as an agent for the artificial preparation of digested food, it is of great service as a direct therapeutic agent in its action on the stomach walls, and its influence in rapidly restoring the normal secretion of the gastric juice as to its amount and its constituent elements.

Pepsin introduced into the stomach seems rapidly to produce an influence, whereby the gastric mucous membrane is stimulated to the increased secretion of pepsin and hydrochloric acid, and a diminution of mucus.

Apart from any action it may exert as an aid in digesting the food introduced into the stomach, it seems to exert, so to speak, a trophic influence; as instanced by the fact that in irritable catarrhal states of the stomach in adults who are fed on completely pre-digested foods, in which the pepsin is destroyed, after its action, by boiling, the mere addition of a little active pepsin by mouth seems at once to bring about a marked improvement in a hitherto obstinate case. Its administration in a mixture containing alkalies, from practical experience, does not seem in any way to interfere with its subsequent usefulness.

One of the best stomachic mixtures for atonic dyspepsia, is one containing an alkaline carbonate, pepsin, and the ammonia citrate of bismuth, with or without *nux vomica*; all in an aromatic solution containing chloroform.

As soon as possible after the commencement of treatment in a case of infantile alimentary derangement, pepsin should be administered by mouth, in the presence of chloroform to prevent the growth of any organisms it may contain.

This is without reference to the withholding or the administering of food.

In many cases, indeed, it is most desirable to promptly stop the administration of food, and rely on nothing more than a small quantity of egg and brandy mixture, with plenty of water; yet even in these cases, pepsin should invariably be found in a prescription.

Bismuth.—This drug is preferably administered in the form of the ammonia citrate of bismuth, as it comes immediately into active and physiological contact with the mucous membrane, and a small quantity of this drug is as beneficial as a greater amount, in fact more so.

For this reason, I have long ago given up the use of the sub-

nitrate, as a cumbersome and crude method of exhibiting the drug. It is questionable whether it has any effect on the mucous membrane of the stomach, and is only reduced to the sulphide in the intestine.

All that can be hoped from the action of bismuth is a mild, astringent influence on the membrane; a diminution of irritating mucus; and a sedative, soothing surface action. It is questionable whether, as claimed for it, it has any direct influence on the innervation of the stomach.

The solution is best given in from one to two minim doses to infants, and ought not to exceed five minim doses for older children.

Alkaline bi-carbonates and *carbonates*, are well known as valuable correctors of hyperacidity, principally lactic and butyric in these cases, and act by diminishing secretion of mucus which is nature's effort to neutralize the acids present. It also calls out an increase of hydrochloric acid by contrariety, and thus tends to prevent extraneous acid fermentation.

Chloride of ammonium, in occasional isolated doses is valuable in rendering mucus more fluid, and in dissolving it off the stomach wall; thereby giving the bismuth directly increased influence on the gastric cells. Dose, from two to five grains.

Hydrochloric acid is only permissible in cases far advanced in convalescence, and should not be used during illness.

Nux vomica, also, on account of its exciting reflex action and increased irritability, is only suited for comparatively renewed health, as a tonic to muscular contraction and secretory action, and must be tentatively used, in spite of the fact that some advise its use as "rapidly restoring the stomach" in gastric catarrh of infants.

The dose of from a half to one minim is amply sufficient at any age under six years, and less for an infant.

Ipecacuanha in the form of the vinum is the best and safest emetic in early cases and in occasional cases of acute indigestion. It is also useful as lowering nervous irritability, after its primary action of causing emesis. In small doses of from two to three

minims it will occasionally be found most useful as a sedative, and can be added to the ordinary alkaline bismuth and pepsin mixture. Under no circumstances should tartar emetic ever be used in a case of intestinal irritation.

We can now summarize by saying that stomachic medication is best served by the use of resorcin and salicylate of soda; perhaps occasionally a few small doses of carbolic acid; and a mixture containing an alkaline bi-carbonate, ammonia citrate of bismuth, pepsin, and an aromatic with chloroform, such as compound tincture of cardamoms.

For intestinal medication one or other of the hepatic stimulants may be used in small doses, such as calomel, grey powder, podophyllin, iridin, etc., with either salicylate of bismuth, salol, or benzol-naphthol, along with castor oil, the consideration of which is deferred till later.

The discussion of opium is also postponed till a later part of this treatise; yet it is nevertheless most important as regards the purposes and the extent to which it is used.

CHAPTER XIII.

ANALOGY OF THE INTESTINAL CANAL AND THE SINUS.

HAVING considered those more important points bearing on the thorough comprehension of and leading up to a rational treatment of deraugements of the infantile alimentary canal, we can now proceed to draw some analogy, which will enable us to go to work in any given case, having a foundation or principle on which to base our efforts; which, though answering in the main all the requirements of a fundamental character, yet is capable of such modification as is necessary in individual cases and in different phases of the same disease without departing from the main idea.

Looking round us, the most apt and feasible simile is to liken or regard the infantile alimentary tract to an ordinary sinus, open at both ends but subject to interruptions here and there by septa or automatic valvular openings.

Unlike an ordinary surgical sinus it possesses walls which in themselves are mobile and capable of active motion apart from the movements of the individual. Also a sinus into which is constantly being introduced foreign material, in the form of the food, in more or less differing conditions as to purity, quality, quantity, and general suitability.

Like a surgical sinus it is constantly under the influence of organisms which may from time to time gain access; its walls are subject to the same conditions as regards rest and irritation, septic fermentation, and undue accumulation of its normal contents and intrinsic discharges, and their liability to undergo decomposition with greater or less evil consequences; they are also capable of diminished or increased secretion under certain conditions, and are finally subject to the same methods of procedure as regards treatment in order to attain to cure.

The great expounder of the true antiseptic principles of surgery, Sir Joseph Lister, laid down as necessary for the easy, rapid, and radical cure of such a surgical affection as a sinus, that certain things must be duly regarded and attained before we could hope to be in a position to effect a cure.

These must be stated briefly to be *asepsis, drainage, freedom from irritation, and rest.* These four fundamental principles when applied to the infantile alimentary tract will be found, under certain necessary and obvious modifications, to be equally useful and necessary as when applied to an ordinary sinus.

That the carrying out of one principle seems to materially aid in bringing about the existence of the others, and that they dove-tail into each other, and, so to speak, "play into each other's hands" in a surprisingly pleasing manner.

To finally summarize we may now say that the rational treatment of derangements of the infantile alimentary canal is based on and is subservient to the attainment and maintenance of asepsis, drainage, freedom from irritation, and rest.

We can modify and change detail of treatment according to individual and disease without the slightest departure from these four main principles.

We will now proceed to consider each principle separately.

CHAPTER XIV.

REST AND FREEDOM FROM IRRITATION.

APART from the generally acknowledged fact that an ailing child or infant must be kept at rest and in general quiet, there are such factors as external reflexes from teeth which are on the point of eruption, and the existence of swollen and inflamed gum substance over the same. These must be promptly released by lancing, and any remaining nervous reflexes from the same sources quietened by the administration of the bromide of potassium.

Cutaneous reflexes, such as cold feet, must be at once looked for and remedied, by two pairs of socks if necessary. Nothing tends to maintain vasomotor dilatation in the intestinal wall like cold feet. The abdomen should be carefully covered—for the same reason—by a suitable and well-fitting belt of woollen material, which should be so fixed, as to prevent its riding up under the arms in the form of a ridge.¹ Naked arms should at once be covered. Though it is necessary to maintain the warmth of the body, it must be clearly understood that anything like approaching over-dressing is equally harmful and must be carefully avoided. It is extremely difficult to hit the happy medium, and, therefore, great care and attention should be here bestowed.

An infant or young child in a constant bath of perspiration and consequent cutaneous irritation and exhaustion cannot be said to be, when suffering from chronic diarrhoea, in a favourable condition for a too speedy recovery. Further, any irritating and itchy eruption about the head and face or any other part of the body should receive prompt care and attention.

Particularly eruptions about the head and face; for, though in the first place, caused by the intestinal irritation and septic

¹ See Appendix.

absorption, all tend, by the unrest which they produce, to react upon the tract, much in the same manner as a vicious cycle, and must not be left to take care of themselves under any plea, not even that they may return or be driven "inwardly," which is either wicked evasion or something worse. Again, excoriation and reddening of the nates, etc., should be properly attended to by a dusting powder, composed of equal parts by weight of light carbonate of magnesia and boracic acid, and oxide of zinc, 1 drm. to the oz. of the other ingredients. Ointments are often too strong and do not always suffice.

Frequently the affection of the nates will resist all efforts at cure, and take on an active inflammatory action; if poulticing with a boracic starch poultice will not suffice, then the constant application of a carbolated solution of weak subacetate of lead, on lint in strips, will almost certainly reduce the affection in two or three days. A very good method is to apply a piece of lint, soaked in the lotion, in every change of the napkin, and, when soiled, consign it to the fire. Irrespective of any existing intestinal and gastric affection, this affection of the nates will kill, by the profound systemic derangement and exhaustion, if unattended. Nothing tends to promote excoriation as a napkin soiled, or wet, undergoing ammoniacal fermentation, which softens and removes the surface epithelium. Their prompt removal must be impressed and insisted on frequently.

We can now consider the matter of rest as regards the stomach and intestinal canal. Remembering the feebleness of the infantile digestive processes in health, we must make due allowance for an increased impairment when ailing. Also that older children at once revert to the infantile condition, or to that of children much younger, on the slightest sign of ill health.

From repeated experimentation with gastric juice withdrawn from the stomachs of infants and young children in ill health, and also by carefully ascertaining the amount of casein given by mouth during the twenty-four hours, and comparing that passed in the dejecta during the same time, I was able to establish an

approximate fact; that little, if any, gastric digestion could be carried out by those fluids artificially withdrawn, and that of the food taken by mouth during the acute stages, in some cases almost the entire amount of the solid albuminoids passed through the intestine without any attempt at digestion.

This compels the patient to fall back on the soluble albumins contained in the "whey" for nutriment. At the same time we must bear in mind that the "whey" contains many of the necessary elements for the production of the chemico-mechanical irritants, such as lactose; therefore the fermentative processes go on unchecked. Add to this any fat, such as the cream usually administered in certain mixtures, along with more lactose, artificially added, and we now possess a splendid medium, on which the organisms already in the stomach can act. So that in a case of fermentative gastric derangement, to begin by stopping casein, and to continue to administer any food made up of the other elements of milk—which seldom are of service at the time they are given—is to provide every facility for the continuance of the disease.

This being the case, we are compelled to look round for some proteid food which will not be too likely to undergo chemical decomposition, which will not coagulate and provide a further obstacle to peptonization, and will not at the same time act as a mechanical, foreign, irritant body, as casein in these cases; and at once we are directed to meat extracts as veal broth and weak chicken tea. I have seen veal broth, though weak, produce general anasarca, with the appearance of albumen in the urine, and both these to disappear on discontinuing the broth. We are thus frequently left to the choice of but one article, and from practical experience of the same I consider it by far the best, from its high sustaining qualities, its thorough peptonizable qualities, and the fact that it can be obtained in all cases and at all times; and that is the contents of a raw egg.

The albumen and vitellin of an egg in dilute solution when raw, was capable of an appreciable peptonization by gastric juice drawn from the stomach of an infant suffering from catarrh. Add

to this any pepsin which might, and ought to be given artificially by mouth, and the consequent beneficial effect of mild functional stimulation, and at once we have a satisfactory food to hand. It is never made in bulk, can be often renewed, and is given at frequent and regular intervals in small quantities.

Whenever beginning the treatment of a case, acute or chronic, it is far the best procedure to interdict all milk, or any of the derivatives of milk, even though rigidly peptonized, pancreatized or sterilized, till the stomach has been rendered fairly aseptic by attending to the mouth, and by the administration of one or other of the gastric antiseptics, by improving and removing the contents of the intestine by an intestinal antiseptic as salol with castor oil and by mildly stimulating the liver. This can fairly be done in from twenty-four to forty-eight hours; after which, if condition, temperature, and dejecta permit, we can resort to one or other of the processes for the pre-digestion of milk. In the meanwhile a careful inspection can be made of all the utensils for holding, and for the administration of milk; alterations made, and thorough disinfection carried out. No good can possibly accrue by giving any milk or product of milk, to ferment in the stomach or to pass on undigested into the intestine to act as a mechanical irritant and fermentative medium.

When returning to the use of milk it is well to bear in mind the need for a lessened quantity in each meal, and a marked lowering of the percentage composition of the several constituents of such food by free dilution; otherwise over-taxation will now supervene, and quantities will be returned or pass on into the bowel, where its absence would be far more preferable. The admixture of the contents of an egg with two tablespoonfuls of warm boiled water, and the addition of one teaspoonful of brandy, omitting the usually advised sugar, makes a good stimulant nutriment, of which one teaspoonful can be given every half hour or every quarter hour according to the condition and age of the child.

Care should be taken to keep a child well supplied with

fluid in the form of water, as neglect to satisfy the concomitant thirst amounts to veritable torture, to say nothing of the mental effect on the patient. Thirst seems to be present naturally, as a means to combat the excessive drain, and the administration of suitably pure water cannot well be wrong.

If more nutriment than the egg and brandy be wanted, then we must fall back upon alcohol in increased quantity, taking care to avoid over-stimulation, or further upsetting the stomach. With due care and attention most cases ought to be fitted to take a modified supply of milk food, peptonized and sterilized, at the end of about forty-eight hours, when the other household arrangements ought to be in safe working order. It is in these stages that the use of such a preparation as a malted milk food alone, or with diluted cow's milk, can be of great service. If desirable, plain diluted milk, previously boiled or sterilized, can be sweetened by the addition of a little active malt extract and administered with advantage. All this is supposing that pepsin, with or without other purely sedative stomachic drugs, has been and is being given. By ceasing for a short while to give any milk we provide the necessary local rest to the stomach, and promote its recuperation; and also stop any irritation taking place in the stomach and lessen the amount of undigested food finding its way down into the intestine.

Under this heading comes the consideration of irritation and the means taken to prevent it, and also, to as far as possible, lessen its evil influence on the bowel itself and, through that, on the system generally. Granting any determining cause as chill, etc., the influence played by the action of the chemico-mechanical irritants, purely toxic irritants or ptomaines, and the simply mechanical irritation of undigested food—in the first place leading to vascular engorgement and increased secretion of mucus, this mucus undergoing acid fermentative change, and the occurrence of swelling with tenderness, and with an increased transmission of sensory reflexes which, in their turn, react upon the vessels promoting further vasomotor relaxation, with consequent augmented

sensibility, now calling forth motor action of the bowel, then muscular contraction pressing on already inflamed and tender mucous membrane, bringing it in closer contact with solid food particles, coupled with the intestinal pressure of pent-up gases—soon leads finally to almost complete vasomotor inhibition, and produces systemic results in the form of derangement of temperature and cardiac action, with inhibition of bile secretion and further consequent fermentative irritation, followed now perhaps by active vaso-dilator reflexes, and an active loss now sets in from the capillaries of the mucosa direct, thus producing frequent watery evacuations of the bowel, and an active and alarming condition, known as Infantile Cholera (secondary), is fully set up.

It is in a series of vicious cycles, such as the foregoing, that the administration of opium in a thoughtful, rational, and cautious manner is of such signal service.

If the disease is seen before its full development, the careful combination of all the fundamental principles accompanied by a rational use of opium—not to repress and prevent the evacuation of the bowel and by so doing retard drainage, asepsis and increase irritation, but to lessen the too easy production of, and the great receptivity and easy conduction of reflex stimuli of a pernicious character—will soon restore matters to a safer and healthier basis.

If seen in the later stages, then again the application of asepsis, permitting free drainage, with strong stimulation, and the free administration of fluid by mouth, and a moderate and rational use of opium, will, in the majority of cases, be attended by happy results. If the flow from the vessels of the mucosa be excessive and prolonged, the prompt stimulation of the kidneys by potassium nitrate or nitrous ether is often followed by good results, from the fact that the consequent fall of blood-pressure by dilatation, even in so small an area as the kidneys, will perhaps suffice to stimulate a rise in that of the bowel. The part taken by the cutaneous vessels in this respect must not be forgotten. The direct action of cold in causing

the abdominal vessels to contract is often of service, provided, in children, the application take the form of a tepid pack to the abdomen only, which can be gradually and slowly cooled down by repeated wringing out in colder and colder water till quite cold. This action should be gradually brought about, and maintained for some time after, to ensure lasting contraction. On no account must it be suddenly induced for fear of pulmonary complications. During the cold application the extremities and the rest of the body should be kept warm and peripheral circulation promoted.

Opium should at no time be given to the extent of paralyzing the motor action of the bowel, and thus locking up decomposing and irritating material the bowel is now anxious and striving to get rid of. The gastric and hepatic functions are necessarily upset; and if one succeeds—which fortunately for the patient one seldom does too soon—then the disease is sure to break out again, when the effect of the drug has passed off, and with increased severity.

Frequent relapses succeed in producing relief to some extent, and if the locking-up effect is still maintained, the disease now takes a chronic course—that is, if the patient survives so far—and thus we get the strictly artificial induction of chronic diarrhoea. All that we should endeavour to effect by the use of opium, therefore, is to deaden reflex, render muscular contraction less painful and shock-producing, attend to anti-septics and diminution of food taxation and irritation, and the vessels at once regain their tone, and the excessive flow from the mucosa ceases or is lessened, and the frequency of evacuation passes away of its own accord. Any pushing of opium necessary, must be aimed at abolishing sensory reflex simply, and should always stop short of its final stage when it produces systemic drowsiness and loss of motor action of the bowel.

The most convenient form of opium is the compound tincture of camphor. The camphor is carminative, and is also a mild stimulant to vascular tone. The preparation can be conveniently

added to a stomachic mixture. There is nothing so important in the successful treatment of these conditions, as the rational and moderate use of opium, not as a cure *in ipso*, but simply as an adjuvant and secondary aid to correct feeding and the use of antiseptic drugs, permitting at the same time a constant and regular evacuation of the irritating contents of the bowel. These points cannot be too firmly and earnestly impressed.

CHAPTER XV.

ASEPSIS AND DRAINAGE.

THE consideration of these two principles of procedure will be markedly assisted by the contents of the last chapter.

Asepsis is divisible into two sections:—General Asepsis—such as the care of the milk after it reaches the consumer, the shape and attention bestowed on the utensils used for stocking the milk, the kind of feeding apparatus used, and the great care which must be bestowed upon cleaning and disinfecting them, and also maintaining them in an approximately aseptic condition—has been fully discussed in a previous chapter, and must be added to this department: and into: Asepsis of the canal proper.

All bibs and clothes soiled by vomit should at once be removed and conveyed out of the immediate vicinity of the patient, as also soiled napkins, etc., etc.

Care and attention should at once be directed to the condition of the buccal cavity, and the presence or absence of the thrush fungus noted, and prompt steps taken to remove and prevent the recurrence of the same.

Inasmuch as the stomach is already infected, and abounds in organisms hidden away in the interstices of the mucous membrane, we had better stop all milk food, or food made from the derivatives of milk, for a short time, till we are able to, at any rate partially, disinfect the stomach, and also prevent the access of any more undigested and fermenting curd to the intestine till that already there has been removed and the general condition of the canal improved; also, till the amount of bile entering the canal is improved in quantity and quality. Bearing in mind that the juice of the stomach in ill-health is likely to have no appreciable action in preventing extraneous fermentation, we must be careful to

introduce all food in a condition as aseptically pure as possible. Further, the necessity of destroying any germs already present is obvious, and directs us to the use of one or other of the soluble gastric antiseptics, preferably resorcin or salicylate of soda.

In the meanwhile the administration of one or other of the hepatic stimulants, as calomel, grey powder, podophyllin, or iridin, in minute and non-purgative amount (given either to stimulate the bile-flow, in order to correct fermentative influences in the intestine, and to promote equable peristaltic action, or administered in a more or less empirical manner) will be of great assistance.

This can be followed by one or other of the insoluble intestinal antiseptic drugs, as salicylate of bismuth, salol or benzol-naphthol, to assist the bile and increase asepsis in the bowel.

After the milk foods have been stopped for a short while, and when the use of the egg mixture has rested the stomach, and has tended to check fermentation, along with any pepsin that could have been given with the gastric antiseptic in combination with opium, we can begin to use the commoner stomachic sedatives as an alkaline bicarbonate, ammonia citrate of bismuth in an aromatic solution containing chloroform in combination with one or other of the antiseptics and minute doses of opium.

The matter of drainage can now be profitably considered.

That it is desirable to free the lumen of the bowel of all decomposing and irritating contents cannot be well denied, and the necessity for this is clearly indicated by the efforts which nature makes of her own accord. All that is necessary for us to do is to render muscular contraction less painful and more equable, with the result of lessened systemic shock and exhaustion. In many cases the natural efforts of the bowel are sufficient, augmented by the peristaltic action of the bile, which is mild and regular in its work.

It is here that the thorough understanding of the use of opium is so useful and necessary.

Early in some very acute cases, before the onset of frequent evacuations, the irritating influence of the contents of the stomach

and intestine can be cut short by the use of a suitable artificial evacuant or emetic such as castor oil or ipecacuanha. In many cases of chronic diarrhoea the constant and systematic use of castor oil is often necessary, and its use is followed by most pleasing results.

Taking into consideration the condition of the canal and the requirements of treatment, we are compelled to look round for such a drug as will act mildly and equably on the whole canal, and at once the only possible drug—castor oil—occurs to us. We also find that it has a locally soothing action on inflamed surfaces, as instanced by its effect on the skin in some eczematous conditions. It acts on the whole tract. It also reflexly stimulates the bile-expelling mechanism to action, and thus tends further to increase the aseptic condition of the canal.

Castor oil, though a common and time-honoured drug, is perhaps after all the most valuable drug we possess in the treatment of septic conditions of the alimentary canal in infants and young children. In chronic cases it should be given as a daily dose in the morning, irrespective of circumstances; and it is well to give a standing order that whether or not mentioned, a dose of from ten to fifteen minims be given to an infant every morning regularly till the case be entirely recovered. A small dose of the drug is far preferable to a large one, and the usual teaspoonful is too much for an infant or young child, and should never exceed half that quantity, which can be repeated if necessary. The longer the disease persists, the more need to administer the daily dose, and frequent scanty stools should, so far from precluding the drug, be an imperative indication for its regular use.

The use of castor oil is popularly said to cause constipation after diarrhoea. This is more apparent than real, as the oil removes and lessens any actively irritating influences, and the milder toxic products act on the walls of the canal, or the absorption into the circulation of septic products, now rendered possible, stimulates the kidneys and keeps up their action with the result of withdrawing all fluid from the canal, as also does the reflex rise of

blood-pressure in the vessels of the mucosa; and thus castor oil is directly blamed as the prime factor of an indirect or remote result.

We can now clearly appreciate how each principle—rest, freedom from irritation, asepsis, drainage—tends, when properly and rationally carried out according to indication and circumstance, to bring about the existence of some or all of the others, and that they are inseparably and intimately connected one with the other.

CHAPTER XVI.

OUTLINES OF TREATMENT IN GASTRIC CATARRH, ENTERITIS,
SIMPLE AND INFLAMMATORY CATARRH, CHRONIC DIARRHEA,
WITH OR WITHOUT SECONDARY ULCERATION.

TAKING into consideration the fact that no two cases are alike, that individuals differ one from the other according to circumstances, and that the several diseases under the heading of "Septic Conditions of the Infantile Alimentary Tract" occur alone or in combination with others, and are subject to various permutations and combinations as to such occurrence, all that can be attempted, in common reason, is to afford a mere outline, which can be added to or extended and elaborated according to the exigencies of the case.

Personally speaking, in early cases, and in those in which it may be necessary, it is as well to remember that certain common lines usually followed in the treatment of febrile conditions, general nervous conditions, both as regards the system as a whole, and the cerebral system in particular, as well as careful attention to the cardiac system and circulation, must engage attention and meet with adequate attendance whenever it arises, that our efforts should be devoted in one or other direction.

In early febrile conditions, and in cases where it is advisable, after the preliminaries of gastric antiseptics have been attended to, we may, in many cases, have resort to such a line of treatment as that pursued for commencing catarrhal conditions of the respiratory tract. The timely administration of a sudorific and a diaphoretic, as spir. æth. nitrosi, and liq. ammon. acet, with tinct. camph. co., or potass. nitrat., potass. bicarb., and tinct. camph. co., is often of great service in cutting short those stages during which the functions of the emunctory and digestive organs are deranged.

and their secretions locked up. Care should be taken to avoid giving spir. asth. nitroso along with any of the aromatic coal tar series, as they become poisonous. On no account should preparations of antimony or aconite be administered to these cases.

As recommended by Professor T. R. Fraser, great advantage will follow, in gastro-enteric affections, the stimulation of the renal system, due probably to the fact that renal dilatation reflexly has a great influence in inducing portal contraction, especially in cases where the flow from the bowel wall is excessive and alarming.

Conditions of the nervous system should be attended to by such drugs as bromides and minute doses of compound tincture of camphor, and attention to teeth about to be cut. The use of such drugs as nitro-glycerine and nitrite of amyl should be very seldom, if ever, resorted to, and even then their efficacy is very questionable.

As regards the cardiac and circulatory systems, there is nothing so valuable as the use of alcohol, taking great care not to over-stimulate, or to stimulate too soon, and thus stimulate the inflammatory process, and not the patient. This requires some care and experience to rightly adjust; generally speaking, the establishment of secretion will form a good landmark, when the question of stimulation can be begun to be considered.

In cases where profound vaso-motor relaxation occurs, and in an immediate and pressing danger, great good can be effected by the cautious use of small doses of digitalis with smaller doses of opium in the form of the compound tincture of camphor; care being taken in collapsed and exhausted cases in the use of opium.

The mechanical force of heat and cold in playing off the cutaneous against the portal circulation must not be forgotten. This is an important factor in the treatment of that profound condition of vaso-motor paralysis and dilatation occurring in the disease known as cholera infantum, especially in that form due to disturbed balance between cutaneous and portal circulation brought about by rapid and extreme changes in temperature and atmospheric

pressure; largely contributed to by cerebral congestion, and derangement of vaso-motor centres in the medulla as a direct result of atmospheric pressure and temperature on the cerebral circulation. This affection calls for somewhat more distinct treatment at its onset than does infantile cholera, secondary to irritative fermentative diarrhoea. In its later stages and when recovering, the consideration of the consequent derangement of the canal and its liability to then take on fermentative conditions must be borne in mind.

Properly speaking, true cholera infantum is really a heat stroke, with portal paralysis; and the intestinal flow must be regarded as a local symptom, though dangerous and important, and one calling for prompt treatment. Primarily, the first thing to recognise is the excessive loss of fluid; this is causative of, fortunately, excessive thirst. Quantities of tepid or luke-warm water must be at once and continuously administered. I have seen an infant of six months drink over a quart in four hours. It is practically one person's work to continuously give water in teaspoonful doses every minute without cessation. The next point in treatment is plenty of fresh air, and above all do not keep the child too warm, as, if collapse sets in, it will be most difficult to control the added cutaneous "cold" perspiration due to "arteriole" paralysis. In some cases the injection of small quantities of distilled water containing 0.5 per cent. sodium chloride at various places, as over the back and loins and under the skin of the abdomen and the axilla, seems to give marked assistance to the volume of fluid in the body and acts as a reserve supply. Care should be taken to see that the water is sterile and the syringe is aseptic: 2 to 4 c.m. at a time is a usually fair dose.

Apply cold, as ice caps, to the head, and resort to a compress (to the abdomen only), at first tepid, then gradually cooling down, and do not use an ice bag as it gives too sudden and too great a shock to the abdominal system.

This brings about a rise of pressure in the cerebral circulation, which relieves the congestion there and the derangement of the

vaso-motor centre, and promotes the rise taking place in the portal system in the meanwhile, by stimulating the vaso-motor centre in the medulla.

Carefully watch the temperature and prevent its falling too low from too long application of cold both to the head and abdomen.

Keep the extremities and thorax fairly but not too warm; pay special attention to the feet. Carefully note state of heart and pulse.

Give stimulants, as brandy, freely, with a small quantity of digitalis to help in toning up pressure in the arterioles. When the stomach permits, the aromatic spirits of ammonia will also be found useful, but beware of its emetic effects in some cases.

Early in the case, great good can be effected by a dose of nitrate of potassium or nitrous ether in order to stimulate renal action and assist portal tone. Have resort only to brandy and egg as nourishment for some time after the flow begins to lessen.

The treatment of this affection is no easy and light matter, and requires the constant presence and unremitting care of the medical attendant. The attack is sharp and smart while it lasts, and is soon over one way or another.

Recovery depends very much on the previous condition of an infant. If originally weakly or very young the chances are lessened, if stronger and older then so much the better.

In the secondary affection, previous exhaustion by prolonged prodromal diarrhoea is against the patient; when it occurs soon after the onset of diarrhoea, things then look more hopeful. Nitrites are dangerous, as being too powerful and too sudden in an already highly dangerous state of the circulation, and may increase the trouble they were given to allay.

When recovering, turn the attention to the intestinal canal and check any septic action that may now begin.

We can now take severally the different ailments as they occur, and very briefly outline treatment. No description of the different methods of preparing food or quantities will be given, as these can be found in text books, and are well known and understood.

Peptonizing, pancreatizing,¹ humanizing¹ milk can easily be done, but must be used at proper times when the conditions of the canal will permit, as also the use of mixtures containing whey, cream, lactose, etc. Sterilization is most important. No exhaustive series of prescriptions will be necessary, and only such drugs as are specially indicated will be mentioned. All these can be added to, according to circumstances and the originality of the medical attendant.

ACUTE GASTRIC CATARRH.

In some cases the administration of a prompt emetic as *vinum ipecac.*, is of service.

Stop all milk food, give egg and brandy, pepsin and resorcin, calomel or grey powder for liver, salicylate of bismuth or salol for the intestine. Examine mouth for thrush, and treat if found. Give castor oil to clear out contents of stomach and intestine. Keep bowels moderately open. (Salol may be advantageously given in castor oil, as also resorcin.)

Follow, when improved, by alkaline carbonate, ammonia citrate of bismuth, pepsin, and tinct. chlor. co. Opium can be given as tinct. camph. co. if impending intestinal catarrh be feared (*see Appendix*).

Attend to utensils and bottles, and sterilize all milk food when given, after acute symptoms have subsided. Give milk, very much more diluted than before illness, pancreatized, peptonized, humanized, and sterilized, according to the means and intelligence of the patients. Of these, if, owing to various circumstances, all cannot be carried out together, then select sterilization of diluted, food supply. All the antiseptic drugs are feasible in this complaint according to their sphere of action.

ENTERITIS, SIMPLE AND INFLAMMATORY.

The treatment is the same as for gastric catarrh, with special attention to intestinal antiseptics, as salicylate of bismuth, salol,

¹ See Appendix.

benzol-naphthol; liver stimulants as calomel, grey powder, etc., castor oil to promote regular drainage by evacuation of all contents of bowel (*see Appendix*).

CHRONIC DIARRHŒA, WITH OR WITHOUT ULCERATION.

This disease should rarely become chronic whilst under treatment as the result of inflammatory diarrhœa or through the irrational use of opium. When seen as such for the first time, the treatment is the same as for gastric catarrh, with special attention to the intestine and stomach on lines laid down previously in this treatise. In ulceration, high up or low down in the bowel, salicylate of bismuth is especially indicated. The salicylate of strontium is often very irritating and is best avoided. When ulceration occurs low down, then employ the above treatment with boracic acid irrigation if the duration of the disease with tenesmus calls for it. Remember that upon the rapid and quick cure of this disease often depends subsequent freedom from enlarged mesenteric glands, enlarged spleen, peritonitis, and, most important of all, the grafting of a tubercular process on a primarily simple one, followed perhaps in some cases by a tubercular peritonitis (*see Appendix*).

CHAPTER XVII.

DYSENTERY AND ULCERATION OF COLON AND RECTUM.

ULCERATION of the bowels can be divided into two classes, that occurring in the small intestine and giving rise to all the usual symptoms of ulceration of the bowels, such as shreds of mucous membrane, pus, and even blood in the faeces; and into, ulceration of the colon and rectum with the above symptoms, accompanied in this case by tenesmus.

Taking into consideration the physiology of the induction of the act of defæcation, we know that the centre for defæcation is situated low down in the spinal cord, and the mechanical stimulus of the presence of faeces in the descending colon and rectum, is the determining cause for excitation of that centre.

We can now understand, that any cause of irritation situated in these regions will call out this reflex phenomenon.

The fact of the existence of sundry denuded and tender surfaces, as ulcers, or the result of true dysentery, is quite sufficient to produce, by irritation, by muscular contraction, or by contact with undigested food particles, irritating mucus, or shreds of mucous membrane, a direct stimulation of this reflex centre.

There is the further fact that such stimulus is in the nature of a "summation of stimuli;" and the peculiar action of the non-striped muscle of the bowel amounts, at each stimulation, to a tetanus of an alternating occurrence. There is also in these diseases an increased nervous excitability, rendering it easy to call out this tetanus. This same excitability is also capable of persisting in its full activity when most other reflexes are worn out and for the time in abeyance. So that, even in an adult or infant in the last stages of collapse, though suffering from relaxed sphincters, it is possible to call out this action in almost its original and full

vigour. Such being the case, and taking into due consideration the exceeding great power it has for producing shock and exhaustion, it is easy to see that the existence of this tetanic contracture of the gut, accompanied by involuntary reflex stimulation and contraction of the abdominal muscles, can and does at times directly contribute to a fatal issue.

However much the occurrence of this exhausting reflex can be controlled by opium and large doses of ipecacuanha in an adult, it is often well nigh impossible to control it in an infant or young child for the following reason: An adult can and does withstand the extreme therapeutic action of opium till the administration of the drug arrives at the point when it is able to control and subdue distant reflexes due to the action of peripheral centres and ganglia, such as the defæcatory centre under the peculiar circumstances of these diseases; in the case of an infant or young child on the other hand, the therapeutic action on the strictly cerebral and general system becomes dangerous long before this point of control of the defæcatory centre is reached in these diseases; add to this the fact that the patient is already very much exhausted and as a consequence more susceptible than before, and that in the cases of ulceration due to inflammatory diarrhoea or the denudation of dysentery, the centre is particularly hypersensitive to the slightest excitation, and has, so to speak, taken the "bit between its teeth" and "run away with involuntary action of the bowel," and the difficulties of the situation presented in certain cases can be clearly appreciated.

It is on account of these almost insuperable difficulties that certain other procedures were devised, such as injections of starch solution, sulphate of copper, perchloride of mercury, tannic acid, etc. These no doubt in some cases, under certain conditions, answered the purpose fairly well; but in others their application has been followed by results, which in some cases can honestly and truly be stigmatised as dreadful.

In fact, in many cases a distinct increase and aggravation of the conditions has followed immediately on their employment.

There is also the use of the local effect of the application of narcotics to the seat of the disease; this is more or less of service, yet does not suffice in some cases. Looking at the indications from symptoms, it does not appear feasible that the application of a direct and powerful local astringent will rapidly and completely effect in a short while that which took some time to develop.

The correct treatment of the affections must have due regard to the fact that time, and time alone, must effect a cure. Nevertheless, we must devise some form of treatment which will meet the needs of the case, be capable of frequent application when necessary, and at the same time exert a continuous and uninterrupted influence for good. From practical experience of various modes of treatment and drugs, I am led to affirm that by far the best drug which we possess in these cases is boracic acid, used in the form of an irrigating solution, and used freely and boldly, not in a half-hearted and hesitating manner. Nothing can be hoped from the use of a limited quantity of fluid, such as a simple enema.

The method of treatment must, in order to carry out the principle of removing all decaying refuse, amount to free irrigation of the rectum and colon frequently repeated at regular intervals, and in sufficiently strong proportions. Solutions of boracic acid used, must not be at the rate of so many drachms to the pint, but must be as much as a quart or two of boiling water will take up and retain when cooled down to the temperature at which it can be used as a warm irrigant.

The following therapeutic actions of the drug, gleaned from actual use, will be of interest:—

It is practically non-poisonous, even in very strong solution.

It is distinctly anodyne in its local effect on the surface of the bowel.

It is directly antiseptic in stronger solution on the contents of the bowel, and on any organism in close contact with and acting on the walls of the canal.

It exerts a mildly astringent action—never enough to destroy

surface cells. My experience of it is that it has the power of stopping recurrence of tenesmus almost like turning off a tap, and the action is perceptible even after the first irrigation.

The tenesmus ceases after each irrigation and remains tolerably absent for some hours after, but returns directly the contents of the gut became sufficiently accumulated ; yet, directly they are removed, it again passes away. This takes place in some cases every four or six hours, and calls for a repetition of the irrigation.

An enema must not be given. It is simply playing at treatment, and does no earthly good except to disturb and further annoy the case to no practical or useful end.

A douche-can should be used, holding at least a quart of warm solution. The fluid should be allowed to run into the rectum by elevation of the can, and can be forced up into the colon by retarding the return along the side of the nozzle by pressure on the anus. Care should be taken to prevent too great elevation of the can, the proper height being from eighteen inches to two feet above the level of the patient's anus.

At first this is difficult to do, but after a little while the bowel becomes tolerant in its lower reaches and permits the fluid to be retained.

After a sufficient quantity has been allowed to run in, the hand being suddenly withdrawn, a rush of fluid takes place, bringing with it all food, shreds and casts.

This little manœuvre can be repeated three or four times during one irrigation, and promotes complete removal of all solid material.

The irrigation is best carried out in the bed, and the best form of bed-pan or bath to use is one made entirely of india-rubber, so shaped as to be entirely open along its whole length and to be capable of being blown up with air along its margins, as this saves the sacrum of an exhausted and collapsed case ; it is also easy of manipulation. There is practically not the slightest fear of rupturing the bowel, if the douche-can be not too much elevated ;

and this should not, under proper care, be for a moment regarded as contra-indicative. The condition of a case is no bar to the employment of boracic acid irrigation; in fact, the more far gone a case, the sooner it is begun, the greater the chance of ultimate success.

This method of treatment has been successfully applied in a large number of cases, but as an illustration the following case will be of interest as being seen for the first time late in the disease, and being by far the worst case among many that have come under my notice from every symptom and point of view.

Girlie, M., st. four and a half years, was seen for the first time, March 4th, 1893, on the eighth day of an attack of idiopathic, putrid, exfoliative dysentery. Comatose, collapsed, sunken eyes, weak, running, thready pulse, temperature in rectum ranging between 103 degrees and 104 degrees. Typhoid condition of mouth and tongue; abdomen drawn in and sunken; repeated, prolonged, and incessant tenesmus, accompanied by "grunt" so familiar in dying cases; passing casts of bowel, shreds, pus and blood. Case was so obviously moribund that a guarded and almost hopeless prognosis was given.

All milk food and beef tea at once stopped. Egg and brandy substituted, fifteen grains of resorcin by mouth, followed by a prescription containing salicylate of bismuth five grains, solution of ammonic citrate of bismuth three minimis, soda bicarb. four grains, pepsin three grains, Tr. chlor. co. five minimis, and tinct. camph. co. five minimis, every four hours. Two hours after, half a teaspoonful of castor oil. Free alcoholic stimulation. Three hours after being first seen, personally administered an injection of two quarts of strong boracic acid solution in successive gushes at the same sitting.

Tenesmus markedly lessened after first irrigation. Returned in four hours, found tenesmus, and repeated the irrigation. The tenesmus ceased, and I left, ordering it again in four hours if necessary.

This was done, and had to be, and was faithfully carried out every six hours, night and day, for ten days.

On the day after first beginning irrigation the tenesmus had almost entirely ceased for the greater part of three hours after every irrigation, and the general condition of the patient was more encouraging though precarious. At the end of ten days the case was so much improved that irrigation was done only morning and evening for four days more and then stopped, as the patient did not seem to need it.

During these fourteen days, no less than thirteen pounds of powdered boracic acid was used; so this shows the strength of the solutions and frequency of irrigations; so much so that when it splashed on a black coat it left a white, crystalline mark.

This case passed quantities of casts with every irrigation, but rapidly improved, and steadily recovered, from the first to the last irrigation without interruption. The irrigations were kept up as long as they continued to bring away shreds and casts from the bowel.

A microscopic examination of early cast, before irrigation, revealed hordes of diplococci and bacilli coli communes, and streptococci; after the commencement of irrigation they grew less and less till they finally disappeared in five days, with the exception of a few bacilli coli communes.

This case was so bad that it took five weeks before strength was sufficiently gained for her to sit up in bed. She ultimately recovered perfect health.

Milk and beef tea were not given in this case unless pancreatized and sterilized, and not until the third day after she was first seen.

The administration of intestinal antiseptics by mouth does not seem to be sufficient, as they do not remain long enough in the bowel in order to reach the colon and rectum.

In ulceration high up, the ordinary treatment, under the lines of this treatise, answers all requirements; but in ulceration low down and in the case of dysentery, and in some cases of typhlitis, we must have additional help in the lower reaches; and from experience of very many methods, and with boracic acid irrigation, the latter can be said to be the most satisfactory and the safest, when carefully and intelligently carried out, under the test of actual practice.

SEPTIC CONDITIONS OF THE

CHAPTER XVIII.

INFANTILE ATROPHY AND CONSTIPATION.

By far the great majority of cases of infantile atrophy, if not all, are more or less directly and closely connected with the septic conditions of the alimentary tract. Granted that primarily they may be due, in the first instance, to defective digestion and unsuitable feeding; still, that would be a great factor in promoting fermentative conditions which would exert influences, calculated to seriously interfere with the general health and produce a lowering of systemic vitality, from the slow poisoning which would subsequently ensue from absorption of septic products. This is noticeable in cases that are suffering from looseness of the bowels, with green colouration, though not what would be called diarrhoea, and which does not attract the attention of those in charge of an infant, the child being frequently brought to see one, on account of being such a "poor little thing"; or, on the other hand, there may be actual constipation, which may be regarded with extreme satisfaction by the guardians of an infant, in that it gives "so little trouble to keep clean."

There is, in a greater proportion of these cases, distinctly a condition of constipation. Besides all the usual routine, of drugs, such as haematinics, etc., which frequently make an upset stomach worse, and inunctions of cod liver oil, and a chopping and changing from one food to another in the vain hope of lighting on something suitable; it is imperatively necessary to give proper attention, not only to some suitable and easily assimilated food, but also to those conditions of the tract which exist, for all that they may not attract notice by their very mildness, yet can and do play a large part in keeping up the condition of "profound marasmus."

Add to the above any structural changes which may have taken

place in the walls of the stomach and intestine, and also in the liver itself, as a consequence of previous irritative conditions; leading to fibrous states of the mucosa, inducing deficient secretion and function, and even in many cases becoming a so-called true atrophy of the mucous membrane of the stomach and intestine, brought about, in the first place, by irritative influences, and secondarily, contributed to by defective nutrition consequent on the former, and on defective tissue metabolism as the outcome of their combined action. We can then clearly and fully appreciate the difficulties and obstacles to be met with and overcome in the treatment of this disease.

It is most striking how a case that has undergone every known method of treatment extant in encyclopedias, and text books, and partaken of every manner or form of food possible, scientific, and commercially proprietary, will rapidly and completely mend under simple treatment based on the lines of complete intestinal asepsis.

One case among many such, will be amusingly illustrative:—

D. V., *æt.* four months, suffering from profound atrophy since birth, with obstinate constipation. When first seen was a veritable "skinful of bones," weighing barely the amount of the bony skeleton at her age. She had been fed on every possible method of preparing milk food, every known and advertised patent food on the market, undergone affectionate and odorous inunction of cod liver oil, and possessed a formidable array of prescriptions containing all the usual stomachics, purgatives, haematinics, etc., and, finally, was the reputed proud possessor of a goat and two kids, prescribed as a last resource, with the assurance that that was the only thing left to do, and, indeed, it was.

Though goat's milk nearly approximates to human milk, still something else was wanted. That was easily furnished by cessation of all milk food, attention to utensils and bottles, a temporary reliance on egg albumen with pepsin, a few doses of resorcin, and salol, along with mild hepatic stimulation, followed by sterilized diluted milk with malt extract in small proportion, and later by a malted milk food, fortified still later by fresh, sterilized, undiluted milk. At the end of a week the constipation was a thing of the past, and, considering the profound emaciation, at the end of a fortnight or three weeks the infant was unrecognisable as the same child. The matutinal dose of castor oil was not omitted.

Here was a case with a loving, distressed and anxious mother, willing to do anything for her child, yet meeting failure at every turn.

It behoves, therefore, medical witnesses at cases which may involve prosecution for cruelty to children by starvation, to be extremely cautious and guarded, for although very many cases of gross cruelty do occur and ought to be mercilessly punished, still grave miscarriages of justice may possibly occur through the spite of a neighbour and the hasty conclusion of an expert witness. This matter is of vital importance to the safety of children and their parents' good name, and should, even in the poorest cases, receive due consideration and attention.

When dealing with conditions of infantile malnutrition, generally regarded as coming under the heading of infantile atrophy or "marasmus," the following considerations must be seriously entered into; as to whether the existing conditions owe their presence to previous derangement (acute or chronic, functional or organic) of the alimentary system itself, brought about by any conceivable possible or probable agency, and thereby conducting to a lowered vitality, with consequent inability to, in the first place, digest and absorb adequate nutriment, and afterwards, to constructively metabolise the same into tissue increase, and even after having accomplished both the former functions, to maintain the condition of potential nutrition and thus prevent subsequent loss by destructive tissue metabolism.

Or, on the other hand, that such conditions of malnutrition may, *de novo*, be due to diathetic, hereditary, or individual conditions; in the first place, either setting up deficient resistance to morbid processes tending to occur in the digestive system; or, in themselves, both with or without previous or concomitant digestive derangement, producing ultimately enfeebled digestion and assimilation, with defective anabolism or even excessive destructive metabolism as a natural consequence.

Whatever may be the position of affairs, it seems fairly plain that, in nearly all cases coming under notice, the question resolves itself into one of adequate or inadequate digestive and assimilative powers, as against quantity and quality of food or nutriment exhibited, their conditions as to easy digestibility, and their co-

efficient of nutritive value as well as the method of their administration.

Of these two the more constantly present factor is that of defective digestive powers; either primarily, the cause of such malnutrition, or secondary to previously existing lack of vitality or developmental energy.

With regard to the other, careful thought and due consideration will usually tend to increase present knowledge, and also, as far as scientific skill can go, to artificially rectify a condition of affairs which owe their presence to more or less erroneous notions, or to defective or pernicious methods of feeding, themselves artificial; and in some cases, to unavoidably inadequate natural conditions, as for instance, derangements of the maternal system in regard to health and nutrition generally, where an infant is breast-fed.

Such being the case, and leaving out of consideration for the present all conditions of fermentation or strictly morbid septic processes taking place in the alimentary canal proper, we must at once turn our attention to the pressing need for promptly rectifying existing digestive defects, rather than to a more or less matter-of-course administration of certain foods or special preparations, simply and empirically administered under the impression that as such and such a drug, or such and such an article of dietary is generally useful or is indicated in these conditions, therefore they must of necessity be useful and necessary to all cases, and will bring about a satisfactory state of affairs irrespective of individual peculiarities or other controlling circumstances. A good example of this is the perfunctory prescription and administration of such an article as cod liver oil to all and every infant who may show the slightest sign of loss of flesh from whatever cause, for the simple reason that cod liver oil is "good for wasting."

There is nothing more disheartening to both medical attendant and the mother of an infant than to have an atrophic condition progressing from month to month in an almost stationary condition of malnutrition as regards recovery, and yet the administration of cod liver oil to have been constantly kept up during this period;

the infant, perhaps, suffering now and then from intermittent attacks of diarrhoea due to undigested oil, even though an emulsion was being used. A great deal of useless trouble and anxiety would have been saved if a short though thorough medication of the canal as a whole had been carried out, and attention given to the digestive powers generally, both of which would have markedly assisted and increased the benefit gained from an undoubtedly most valuable nutritive agent, and have shortened the duration of the need for such administration.

It is as well here to bear in mind the fact that oil emulsions have a tendency to "separate out" or "globulate" when exhibited under conditions of excessive acidity, such as is found existing in the infantile stomach in these derangements, thereby tending to render entirely nugatory any scientific process of emulsification.

Putting an infant on cod liver oil is significantly graphic in more senses than one, in that often when "put upon it" the infant remains there; and in some cases is only rescued from a premature end by the prompt recognition of the harm which sometimes ensues.

Add to all the above considerations the fact that, in most cases we have to contend with directly atrophic and fibroid changes in the mucous membrane of the alimentary canal in these conditions, with consequent diminution and impairment in quality of the several digestive fluids and secretions, and the difficulties of the situation can be fairly appreciated. Hence, when, or before administering such a nutritive medium as cod liver oil, care should be taken to ascertain the digestive conditions of the infant; and it will be found necessary in nearly all cases to previously attend to, and as far as possible rectify any digestive defects, from whatever cause, as otherwise, if no actual harm be done by the oil, very little good will accrue, and that only after an unconscionably lengthened period. This will be more easily accomplished if the so-called "trophic" action of pepsin be made use of, accompanied by bismuth with an alkali (the bismuth being preferably in the form of the ammonia citrate

of bismuth); as the mucus secretion being diminished, the cells of the mucous membrane are brought into closer contact with the fat, and hence increased absorption is promoted.

Care should be taken to keep the amount of oil administered in any one dose rather below than above a certain average, as any excess of oil simply acts as a purgative and tends to unnecessary looseness, which especially may be the case in hot weather. Cod liver oil should usually be administered as so many drops at a time to children under five years of age. The proverbial teaspoonful is too large, and this is also the case with emulsions. As regards "inunction"; with due care, cases needing this process will become fewer, and with advantage, as it is a disagreeable and trying process for all concerned.

Useful combinations of cod liver oil with phosphorus compounds as the hypophosphites of soda and calcium, and the phosphates of calcium and iron must be borne in mind, not only for their direct nutritive value, but also for the large part they play in the promotion of cerebral nutrition, and consequently on nervous promotion and control of metabolic processes. (See Appendix.)

In the administration of all fats, it is well to remember the absolute need for the constant presence of an appreciable amount of bile in the intestine, as not only is the emulsification and saponification markedly assisted by bile, but emulsified fats pass through animal membrane with greater ease when the membrane is moistened or bathed in liquid bile.

This brings us to the consideration of the administration of hepatic stimulants in these conditions. The common remedy is mercury, usually in the form of grey powder. This drug undoubtedly increases the flow of bile, and thus tends to conduce to increased asepsis in the canal and more efficient assimilation of the food; given in very occasional and isolated doses it often accomplishes great benefit; but to prescribe a series of daily doses, spread over a period of a week or ten days, as the practice is with some, must be classed as extremely problematical as regards benefit.

Apart from the direct action of mercury on the alimentary organs, we must bear in mind its tendency to promote at the same time increased systemic tissue metabolism, most frequently of a destructive character, and also to reduce the normal relations of the constituents of the blood, from its destruction of red blood corpuscles; so that it is highly probable that any good which might accrue from its use, and from the first dose or so, might be annulled or even converted into a co-efficient of harm by the subsequent doses of the series.

Isolated doses of grey powder at various intervals of from five days to a week, will accomplish more than a repeated and frequent continuous administration, which though indicated for certain reasons are for others mainly harmful. This perhaps, is the cause why a case of infantile atrophy treated with mercury by continuous series of doses continues to come up for treatment, and also continues to take mercury. In this respect and from actual practical experience, it seems that the vegetable hepatic stimulants such as podophyllin, gr. $\frac{1}{6}$ — $\frac{1}{4}$, iridin gr. $\frac{1}{2}$ — $\frac{1}{8}$, etc., daily, do as much good, and often effect the same in a shorter time. Mercury and opium are two of many drugs commonly administered to children, whose action is greatly enhanced for good when given along with another commodity, which, whether administered as adjuvant, excipient, or vehicle, may be aptly described as "due deliberation."

Owing to the fact, that some infants and young children exhibit the individual peculiarity of being unable to digest fats or oils in any form, it is as well to bear in mind that great good may be effected by the substitution of an easily assimilable carbohydrate. Though the co-efficient of nutrition of carbohydrates is very much lower than that of the hydrocarbons, still owing to the conditions of easier and better adapted digestibility as regards the peculiarities of the individual, the lesser nutritive here possesses the greater "morphic" nutritive co-efficient.

The most convenient form of administering a carbohydrate is undoubtedly malt extract, which is not only a fully digested food—thus saving trouble and errors in preparation so commonly the fault

of so-called "diastased" foods—but possesses the additional advantage of being able to assist in the digestion of other food-stuffs, such as milk, etc. It is also capable of combination, in varying proportions, with oils, with which it forms most complete solutions, or emulsions, and is capable of acting as a vehicle for such drugs as phosphorus and iron, which are of surpassing value in these conditions of infantile disease. Malt extract alone or in combination with phosphorus and iron, such as the phosphated (ferrated) extract of malt, can be used with advantage as a sweetening agent to food and as a haematinic and bone-forming agent in conditions of anaemia and rickets so commonly causative of, concurrent with, or a consequence of, infantile malnutrition. It can also be administered medicinally in combination with syrupus *ferri phosphatis*, equal parts, with great and immediate benefit.

Indeed, apart from the great benefits to be obtained from its use in the feeding of comparatively healthy children, it is highly probable that malt extract and its various combinations might be awarded the prior place to cod liver oil, and in the treatment of most cases the use of malt extract be relied on primarily, at any rate till conditions of improved digestion warrant and permit the subsequent administration of cod liver oil, alone or in combination with malt extract and other drugs such as phosphorus and iron. (See Appendix.)

In certain cases of atrophy and rickets, especially in children over one year of age, great benefit can be obtained by the administration of the elements of meat substance, as myosin, the several constituents of blood, as haemoglobin, haematin, etc., and contained salts; indeed, some cases do not really begin to mend till these are exhibited. In other cases of otherwise healthy children, fed on farinaceous foods, the early oncoming signs of rickets can be promptly checked by this method. The above can easily be accomplished by using the method of preparation described elsewhere for "cold drawn" meat extract. (See Appendix.)

The existence of sundry and various "Special Foods" is duly borne in mind. Their name is legion, yet they all depend on the

diastatic action of malt for their claimed special recommendation some possessing it, others only partially, others again not at all. The use of any of these must be left entirely to the judgment of the skilled mind, and must be approached with a due regard to the demands of utility, efficacy, and the best interest of patient primarily, and nothing else afterwards.

It is not by any means the intention of the author to enter upon wholesale condemnation of these preparations. We all owe a great debt of gratitude for the ease and facility with which we are able to treat our various cases which need change and variety. The are, however, certain facts which it is impossible to ignore, and the main one is, that no matter how perfect a composition or how excellent the preparation thereof, nature demands always something which they can never supply, and it is to the failure to recognise this that has caused many to entertain a perhaps unreasoning prejudice against their use.

Partially digested or totally predigested or malted farinaceous foods cannot supply to carnivorous man the elements associated with the consumption of fresh meat food, and these containing myosin and haemoglobin. Total reliance on these preparations give rise to an increase of fat at the expense of the other constituents of the body, tending to anaemia—hence the fat pale pasty baby—and to enlargement of tonsils and adenoid vegetations, hence the need for subsequent operative interference in almost every case. (From personal investigation it has been found that almost every case coming for tonsillotomy has been mainly and purely carbohydrate fed after eighteen months old to three years of age.)

Bearing these facts in mind and being prepared at any time to counteract any deficiencies from their too free and too sole use, by the administration of necessary carnivorous food, we may in many cases use these preparations with great advantage; also, that no food extant will suit every child or is in any way a specific for every case of disease, and carefully to avoid pinning blind faith to any one food, as food A may in some cases give place with

advantage to food B, and in others, food B again be replaced by food A, and in yet other cases, both A and B, or either, have to give place to food C, and so on, *mutatis mutandis*; so that, to sweepingly condemn a food because it disagrees with a few cases is manifestly wrong and unfair. Consequently no one food belonging to a class or series of foods, can with the least honesty or common sense be said to be far superior to any other one of the same class. They are all superior, each to its special individual infant whom it suits and agrees with. For the above reasons there will be found in the Appendix a short description of a few out of many composite predigested foods (partially or totally), for the sake of guidance, having no preference for one over any other. (See Appendix).

CONSTIPATION.

Whether relative or actual, need not amount to complete obstruction of the bowels in order to attract attention to the high probability in many cases, that it owes its origin or maintenance to septic fermentative changes in the alimentary canal.

It is probable that in many individuals, certain degree of pressure, which in others would be sufficient to set up an intestinal storm, culminating in an inflammatory storm, may, through failure of the excitability and conduction, or special powers of resistance, not succeed in bringing about those milder results of stagnation which we can reasonably associate with constipation. Primary, faulty or defective gastric digestion has a large part to play in a suitable state of affairs for the promotion and maintenance of those septic changes taking place on refuse food in the canal.

To all intents and purposes, an infant or young child, passing very costive and passing faeces, which to all appearance are completely disintegrated by the processes of digestion, may *not* be in a condition of apparent complete digestion and over-absorption of faeces entirely to the action of organisms of the intestine, when the food has left the stomach in an inadequate condition of absorption.

In this respect it is important to bear in mind the two years

stools passed on one day, do not owe their origin to immediately preceding meals or to the meals of the day before, but in nearly all cases to the meals of two, three, and even four days previously.

This can be clearly and fully proved by any one for himself, by altering the haphazard daily single scybalum or so, passed by a case of constipation, to one or two fair stools in the twenty-four hours. This will not take place till the remaining obstructing mass be cleared out of the way, which will take some trouble and a little time to effect, perhaps two or three days. Care should also be taken not to unduly hasten or hurry the passage of the food, as milk curd, along the lumen of the bowel, but allow it reasonable time of sojourn, in order to do away with any fallacy from this source. Omit to give any drug to whose action can be attributed a deterrent effect on bacteria, and select such an agent as a mild dose of saline laxative, such as a magnesium salt in quantity too small to seriously affect the flow out of or into the lumen of the bowel.

The observer will now be astounded at the vast amount and preponderence of unaltered curd and starch material, according to circumstances, which will now appear as a constant constituent of the dejecta.

This condition will be easily rectified by attention on the lines of this treatise, as cleanliness of utensils, bottles, sterilization of suitable food, the administration of pepsin, antiseptics, hepatic stimulants, etc., etc., and even though the stools may be increased in frequency to three or even four during the twenty-four hours, yet they will now show less curd, or little, if any, and gradually become normal as to consistence and colour. Care should now be taken to maintain drainage as by the matutinal small dose of castor oil.

To a careless or lay observer the condition of the scybalous stool is attributed to hyper-digestion with over-absorption from the bowel, and when the curd makes its appearance at the beginning of treatment, will often lead to some slight difficulty for the medical attendant, in that its appearance is at once illogically attributed to newly induced defects in digestion, which really

existed all the time, and result in opposition or deceit on the part of the attendants in fully carrying out the details of treatment, thus inducing a rapid return or relapse to organism-altered faeces and failure, with discouragement to the practitioner. These little points are of importance and should be looked out for, and carefully explained and alarm allayed.

The following case will be amusingly illustrative of the sort of experience commonly met with, as a strictly lay interpretation of previous medical opinions.

A case of obstinate constipation was brought for treatment on account of extreme wasting, accompanied by irritating eczema of the scalp and face. When the mother was informed that the cutaneous eruption, which was distressing the child and interfering with its proper rest, should be treated and cured, she informed me that her doctor had told her (he was a homœopath) that if interfered with it would be "driven inwardly" and give rise to something else, and absolutely refused to have it treated. When informed that the constipation should be attended to she again opposed, stating that she understood from her doctor that, as the infant was weakly and unable to obtain its nutriment like other children, it (constipation) was a wise provision of nature for delaying the passage of the food, in order to permit the weakly infant to obtain all the nutriment (ptomaines?) it could from the food, because it required more time than other children. She refused to let it be treated for constipation, so the case was abandoned as hopeless, and she was sent back to the homœopath.

In older children, resort to the usual expedient of the administration of fruit cooked or stewed will often be of assistance, as well as other expedients already well known and needing no further mention here.

At the commencement of treatment in obstinate cases, the value of the plain warm water irrigation of the lower bowel must not be forgotten, and must not be discarded under the popular plea that its use leads to permanency of the disease, and therefore it is contra-indicated. If it be relied on solely, and other important items of treatment neglected, then there can be small wonder that its use alone does not relieve a condition owing its origin to causes higher up and left untreated. One cannot be surprised that simple enemata in the past failed to cure constipation, when all the possible circumstances of its origin and maintenance are taken into account and duly considered.

CHAPTER XIX.

TUBERCULAR AND TYPHOID ULCERATION.

THESE two affections owe their origin and maintenance, as is already very well known, to specific germs.

With regard to tubercular ulceration, and tubercular peritonitis which may follow, very little can be said other than the application of the systematic treatment on general lines here laid down. The drug that seems to be of greatest service in the intestine is the salicylate of bismuth, with an occasional dose of non-mercurial hepatic stimulant, such as podophyllin or iridin in small quantity. As this disease is extremely difficult of cure, if at all, it is best to devote our attention to the milk supply as advocated elsewhere; and also to endeavour, as soon as possible, to remedy those other affections of the canal which may provide a suitable opportunity and nidus for the grafting of the tubercle bacillus on to the mucosa, as for instance, chronic diarrhoea and ulceration, not tubercular, in its origin. General attention to diet and sterilization of food, with adjuvants such as cod liver oil, arsenic, and iron preparations will do most, if any, good.

Speaking guardedly, advisedly, and somewhat speculatively, seeing that tuberculosis, as generally understood, comprises an acute or miliary tuberculosis, and a chronic or infiltrative and necrotic tuberculosis, it may ultimately turn out that both the acute and chronic varieties are due to a fundamental alteration of the nature, action, and propagation of the tubercle bacilli, tending to widely separate their mode of attack. That, perhaps, in the type we know as chronic tuberculosis, that is, the invasion of the bacillus, the concomitant cell formations, and the ultimate breaking down of the invaded tissue, this last may in reality be a result due to the action of hitherto undiscovered and undescribed organisms, or perhaps may be the direct result of the

action of the commoner pus-forming organisms.¹ That, in reality, tuberculosis as we know it and as it manifests itself, by emaciation, febrile disturbances, etc., is really the result of the secondary action of other organisms, to whom the tubercle bacillus acted as forerunner and preparer of soil, and that our efforts at cure of the chronic affection, and, indeed, of the acute affection, should be directed to hunting out and counteracting the secondary organisms, preventing their destructive action, and thus leaving only the separate and primary action of tubercle alone to be counteracted by subsequent hygiene, judicious feeding and systemic nutrition. Seeing the absence of those symptoms at the commencement of tuberculosis which we find at the end, when the disease is drawing to a close, and that the tubercle bacillus has been conclusively proved to be present in the tissue under both conditions, we can reasonably expect that perhaps we may have to deal with other agents latterly. Knowing the peculiar inflammatory reaction of tubercular areas to the injection of Koch's serum, and seeing that there is little or no reaction of a like nature except an urticaria at the site of injection in the case of Behring's serum and streptococcal serum when used in diphtheria and infective inflammations, here then appears a discrepancy, and it may be that the inflammatory reaction of tubercle is perhaps due to the activity of some organism other than tubercle which the "tuberculin" tends to call into active evidence. Possibly the attempt to treat pulmonary and intestinal tuberculosis by serums directed against the disorganising or pus-forming organisms, may be ultimately productive of good, especially in those stages when the affected tissues begin to break down, or even before. This does not seem so entirely hopeless when we look back upon the cases of phthisis which have recovered, after the lung has broken down, and the disease becomes quiescent, leaving merely the vomica as evidence of previous tuberculosis; also after operative interference. Perhaps these cases have been automatically immunised from the action

¹ Lake on Intra-laryngeal tuberculosis. (*Amer. Journ. Med. Science.*)

of the disorganising agents during the process of destruction of tissue which they were fortunate enough to have survived.

With respect to the septic condition of the tract in typhoid fever, the following will be most interesting: In adults by far the most valuable drug is carbolic acid administered in pills, two minims in each, coated with keratin, every four hours, and increased to two pills every four hours, that is four minims, if necessary. Also the salicylate of bismuth, and salicylate of quinine.

In children the most valuable drug, since carbolic acid is only now and then admissible, is the salicylate of bismuth. This was the result of a series of trials during the year 1891, in which I found that with this drug the temperature ranged lower as a whole over a certain number of cases than in others under the ordinary quinine and acid treatment. Yet in spite of all that could be done, there was a certain number of cases with the usual cerebral and stomachic symptoms of a disagreeable nature. It is advisedly advanced that in most cases a great deal of the systemic and cerebral poisoning is practically due to the effects of the extractives which we administer in the nourishment. In many cases the excessive amount of beef-tea which is administered may be directly causative of the great prevalence of waste-product poisoning which is present, and which probably accounts in a great measure for the typical facies of the cases. This is perhaps due to the mode of preparation of beef-tea commonly pursued; that is by boiling, in which we chiefly obtain extractives such as kreatin, kreatinin, sarcolactic acid, leucin, urea, and uric acid, and very little of the true nutritive albuminoids. With this fact in view, a cold drawn extract of beef pulp in a neutral saline solution, freed of all meat fibre and solid matter seems to be of higher nutrient value, and when well peptonised and sterilized, to be of greater service and requires to be given in less quantity than ordinary beef-tea.

The following method of preparing beef extract¹ may be of interest: One pound of good steak is freed from all fibrous tissue

¹ See also Appendix.

and fat, and then reduced to pulp in order to rupture the sarcolemma. The pulp is then treated with a pint of cold, weak sodium chloride solution, one per cent. The mixture is allowed to stand for a while and then, either before or after gentle heating—not boiling—it is rubbed through a hair sieve. The mixture of curdled albumin, containing haemoglobin and extractives in the clot, is then dialysed to free it from all salt and crystalline extractives. It is then peptonized or pancreatized, and finally sterilized. We now possess a pure solution of peptone, as free as possible from too much waste product, which undoubtedly plays a great part in directly contributing to the conditions familiarly associated with typhoid fever.

Whether from these reasons or that the broth becomes split up into poisonous derivatives by the action of organisms, these facts are worth bearing in mind. In the treatment of typhoid fever the following results of a series of fourteen cases taken consecutively, without a single fatal case, may perhaps be interesting.

Acting on deductions drawn from some experiments on the spleens of deceased cases of typhoid fever by Messrs. W. Soltau Fenwick and T. J. Bokenham (*British Medical Journal*, April 13th, 1895)¹ in which they appeared to have proved and established the fact of albumose poisoning, I proceeded as follows:—Knowing that organisms of a nature acting on sarcous matter will not to any great extent live in or act on a solution of vegetable acid, such as tartaric or citric, I began to supply a series of cases with fruit acid *ad libitum*, and selected orange juice as the excipient, and in the cases of adults ordered a dozen or more oranges to be within reach, and directed that whenever desired, the juice of an orange should be expressed into a tumbler and taken so, or diluted with water. Express orders not to include the pulp or the slightest fruit substance were rigidly impressed. In the case of children, the attendants were directed to administer the juice as desired.

¹ It seems clear that Monsieur A. de Bavay whilst experimenting on the effect of yeast and acids in the treatment of typhoid fever, also found an albumose poison which he attributes to the action of another organism than typhoid bacillus. (See paper—*Australian Med. Journal*, 1891.)

On account of the thirst present, it can be imagined with what delight such an addition to the dietary was hailed. This was carried out faithfully and honestly in fourteen cases—eight adults and six children—taken consecutively up to the date of writing this treatise without a break and without a death. They had, as well, carbolic acid and salicylate of bismuth, so their effect must be taken into account. The diet consisted of cold-drawn beef extract made in the kitchen, and diluted milk, both of which were zyminised with Fairchild's powders (B., W. and Co.) The following points are of interest: In all the cases, typhoid fever was first carefully diagnosed by the usual symptoms, stools, rash, frontal headache, dilated pupils, tongue, peculiarity of temperature, and general facies, and Ehrlich's test.

In some cases there were present signs of cerebral disturbance, sordes, etc. When put on orange juice, the following took place almost immediately: The headache disappeared in every case, the tongue promptly cleaned, and the mouth became moist and the breath sweet, the head became clear, and the mental faculties capable of sustaining such light amusement as comic papers, the pulse rate was less and the beat more regular and full. The temperature still continued its normal typhoid course, though it ranged on an average somewhat lower. The general condition and subjective symptoms were so light that in some cases the adults refused to believe that they were suffering from the disease. One case pestered me to let him go out, his stock of oranges ran out, and could not be replenished for some reason, and he rapidly developed all the usual typhoid symptoms. His temperature was never at any time below 103° Fah. One or two patients tried grapes in the same manner with most uncomfortable results, and resumed oranges with ease. It is not pretended that there is any special virtue in the oranges, or any peculiar properties in this method of treatment. It is here recorded only as interesting, and must be taken for what it is worth, nevertheless, the fact remains, that a certain consecutive series of cases, taken as they came, were treated alike without an anxious moment or an untoward symptom. There was a strange

absence of meteorism in all these cases. It may have been that these fourteen cases were all mild, and would in any case have recovered, or that it was impossible by any process to have killed them; or it may have been due to the drugs given. Still, I was impressed with the result, as were others who saw the cases, and think that the experience of other practitioners on the same lines might be interesting and perhaps of some value in the treatment of, at any rate, those symptoms of typhoid fever attributable to the fermentative action of sarcous organisms and the toxic effects of the absorption of their products. At any rate, if only for purposes of allaying thirst and discomfort arising from the parched condition of the mouth, it does not appear that the administration of a pure fruit juice, free from fruit substance, is any more harmful or contra-indicated than other forms of food and nutriment usually exhibited.

CHAPTER XX.

CONCLUDING REMARKS.

THE foregoing subject matter is put forward as by no means a panacea for all possible evils occurring in the infantile alimentary tract, still it is hoped that in a certain number of those cases which used to occasion an amount of trouble and anxiety, will for the most part cease to do so under the so-called antiseptic treatment of affections of the infantile alimentary canal, owing their origin or maintenance to fermentative changes taking place as the result of organisms of strictly chemical, or specific action.

From experience of practice carried out on the lines herein laid down, it can at least be hoped that those cases running a prolonged and chronic course will become more conspicuous by their absence. Unless seen primarily as chronic cases, few early acute cases should run on and take up a chronic course while under treatment; so much so, that should that event occur, it can be strongly urged that some part or section of the general treatment is being neglected or inadequately carried out, and inspection will in most cases reveal a breach of rational procedure in the department more properly under the control of lay attendants, which in the majority of cases arises unwittingly and innocently. The rectification of this by the medical attendant soon suffices to direct matters to a happy and successful issue.

Cases of chronic diarrhoea, with or without ulceration and prolonged constipation, which in the past are heard of as lasting for six, nine and twelve weeks, should in most instances take a more favourable course in from four days to a week, and a fortnight at the most should see the majority of cases in comparative health.

It is only fair to acknowledge, that in a certain small percentage of cases brought for treatment, success on any lines will be almost

impossible to attain, for the reason that they occur amongst the more pitifully poor, helpless and ignorant; and although there may exist every desire and intention to faithfully and honestly carry out instructions, still, circumstances of lack of means and ability preclude and induce to failure, which could have been avoided under more favourable surroundings.

Among these are also cases which will more frequently occur in connection with those institutions where medical advice is obtained at the hands of limited liability associations, where the rush to pile up dividends for shareholders, limits not only the time, trouble, and solicitude, so needful in these cases; but also for the same reasons necessarily, the skill and carefully attentive experience brought to bear on an aggregate of cases enticed purely for the sake of commercial ends. In these respects, though acknowledging the undesirability of special hospitals or institutions, yet it is commended to the charitably inclined, that in rural districts and in certain parts of townships, small establishments such as a sanitary cottage or small house be fitted up with a few cots, where adequate care and attention may be bestowed on the infants—the offspring of those whose position precludes sufficiently exact domestic care—where, say for the space of a week or as long as was absolutely necessary, they may be housed, fed, attended by local skill, and receive the additional care of trained nursing, such perhaps as most district nurses can easily provide. All cases treated, of course, to be limited to intestinal cases purely, and, as a consequence, limit also the calls on the pecuniary resources of these institutions.

Finally, let it be clearly and completely understood that much sacrifice of curtness and brevity has been made in the interest of necessary detail in descriptive and explanatory passages in this endeavour to reduce the treatment of septic conditions of the alimentary tract as far as possible to a rational system, capable of modification according to case and circumstance. Let me conclude with the suggestion that the watchword of all desiring proficiency in this department of Pediatrics should be "Attention to Detail."

PREFACE TO APPENDIX.

THE author has added a short Appendix in the interests of desirable practicability, and as an aid to the more clear interpretation of the foregoing text, especially the classification of foods. This addition is, for obvious reasons, necessarily made as short as possible, and is not put forward as exhaustive yet it is hoped will be of some slight assistance to those who care to avail themselves of its use.

APPENDIX.

FORMULARY.

The dosages of the following prescriptions are for a single dose, and are regulated for an infant *three months* of age; above and below that age the practitioner can regulate *pro rata*.

FEBRILE CONDITIONS.

At the commencement of any gastro-intestinal derangement.

Emetic.—℞. Vin. Ipecac. 5ss.—ʒi.

Endeavour to avoid the use of antimony, nitrite of amyl, and nitro-glycerine.

“Diuretic.”

(1) ℞. Potass. Nitrat. gr. ii.
Potass. Bicarb. gr. ii.
Tr. Camph. Co. mii.
Syrup. Aurant. m. vi.
Aq. ad. ʒi.
Sig. : Tert. horis.

“Sudorific.”

Or (2) ℞. Spir. Ætheris. Nitrosi. mv.
Liq. Ammon. Acetat. mx.
Tr. Camph. Co. mii.
Syrup. Aurant. mvi.
Aquam ad ʒi.
Sig. : Tert. horis.

“Diuretic.”

(3) ℞. Potass. Nitrat. gr. ii.
Liq. Ammon. Acetat. mx.
Tr. Camph. Co. mii.
Syrup. Aurant. mvi.
Aquam ad ʒi.
Sig. : Tert. horis.

Or (4) ℞. Potass. Acetat. grs. ii., vel
Potass. nitrat. grs. ii.
Spir. Ætheria Nitrosi. miv.
Aquam ad ʒi.
Sig. : Tert. horis.

Note.—Resorcin, grs. ii.—iv.; carbolic acid, m $\frac{1}{2}$; or glycerine acid carbolic, m, ii. may be given in ℞ (1).

When exhibiting any of the coal tar series, remember to avoid the use of *Spir. ætheris. nitrosi.* in the same mixture, and allow a short time (one hour) to elapse before giving one after the other.

ACUTE GASTRIC CATARRH.

"Antiseptic Evacuant."

(1) B_e Glycerini Pepsini mii.—ii.
Resorcini gr. 2—4.
Ol. Ricini mxxx (or less)
Glycerini mxxx.
Ft. : Haust.

"Antiseptic Evacuant."

Or (3) B_e Salol gr. $\frac{1}{2}$ —1, vel. Bismuth Salicylat. gr. 2—4.
Ol. Ricini mxxx. (or less)
Glycerini mxxx.
Ft. : Haust.

"Antiseptic Evacuant."

Or (2) B_e Glycerini Acid Carbolic mii.
Ol. Ricini mxxx. (or less).
Glycerini mxxx.
Ft. : Haust.

"Antiseptic Evacuant."

Or (4) B_e Calomel gr. $\frac{1}{2}$, vel. Hydrarg. cum cret. gr. i.
Ol. Ricini mxxx (or less).
Glycerini mxxx.
Ft. : Haust.

Followed by—

"Stomachic Antiseptic."

(1) B_e Glycerini Pepsini mii.
Resorcini gr. iii.
Soda Bicarb. gr. ii.
Liq. Bismuthi et Amm.
cit. mii.
Tr. Chlor. Co. miv.
Aq. ad 5i.
Sig. : Quart. horis.

"Antiseptic Reflex Sedative."

Or (2) B_e Glycerini Pepsini mii.
Glycerini Acid. Carbolic mii.
Tr. Camp. Co. mii.
Tr. Chlor. Co. miv.
Aquam ad 5i.
Sig. : Quart. horis.

"Stomachic Antiseptic" and "Reflex Sedative."

(3) B_e Glycerini Pepsini mii.
Resorcini gr. ii.—iv.
Tr. Camph. Co. mii.—iii.
Liq. Bismuthi et Amm.
cit. mii.
Syrup Aurant. mvi.
Aquam ad 5i.
Sig. : Quart horis.

Or (4) B_e Glycerini Pepsini mii.
Salol gr. $\frac{1}{2}$ —1.
Resorcini gr. ii.—iii.
Soda Bicarb. gr. ii.
Tr. Chlor. Co. miv.
Mucilag. Tragacanth (gr. $\frac{1}{4}$) 5i.
Sig. : Quart. horis.

"Stomachic Antiseptic."

Or (5) B_e Glycerini Pepsini mii.
Bismuthi Carbon. gr. ii.
Sodii. Bicarb. gr. ii.
Salol gr. $\frac{1}{2}$ —i.
Aq. Chloroform mx.
Mucilag. Tragacanth (gr. $\frac{1}{4}$) 5i.
Sig. : Quart horis.

Or (6) B_e Glycerini Pepsini mii.
Acidi Carbolic dil. m $\frac{1}{2}$ —i.
Tr. Camph. Co. mii.
Liq. Bismuthi et Amm. cit. mii.
Tr. Chlor. co. miv.
Aquam ad 5i.
Sig. : Quart. horis.

"Carminative Stimulant."

(7) B_e Glycerini Pepsini mii.
Salol gr. $\frac{1}{2}$ —i.
Soda Bicarb. gr. ii.
Ammon. Carb gr. $\frac{1}{4}$ — $\frac{1}{2}$
Syrupi: mx.
Aq. Carui. ad 5i.
Sig. : Quart horis. ex. aq.

"Hepatic Antiseptic"

Or (8) B_e Calomelanos gr. $\frac{1}{2}$.
Glycerini pepsini mii.
Soda : Bicarb. gr. ii.
Resorcini gr. ii.—iv.
Syrup : Aurant. mx.
Mucilag. Tragacanth (gr. $\frac{1}{4}$) 5i.
Sig. : Quart. horis. donec. capt. haust. sex.

"Hepatic, Antiseptic."	"Malarial, Tropical Cases."
(9) R. Glycerini Pepsini mii. Resorcini gr. ii—iv. Liq. Bismuthi et Amm. cit. mii. Liq. Podophyllini (Hockin) mi. Syrup Aurant. mx. Aquam ad 3 <i>i.</i> Sig. : Quart. horis.	(10) R. Glycerini Pepsini mii. Quin. Salicylat gr. i—ii. Bismuthi Salicylat gr. i—ii. Tr. Camph. co. mii. Syrup : Aurant. mx. Mucilag. Tragacanth (gr. 4) 3 <i>i.</i> Sig. : Quart. horis.

Or, later, any of the following habitually useful mixtures in combination with—Resorcin, gr. ii.—iv.; glycerine acid carbolic, m. ii.; salol, gr. $\frac{1}{2}$ —i.; salicylate of soda, grs. 2—4; salicylate of quinine, gr. i.—2; salicylate of bismuth, gr. ii.—4; benzol-naphthol, gr. i.—iii. (except in cases where the kidney is liable to be harmfully influenced). Selecting one or either of the above, according to circumstances, and adding mucilage where the drug happens to be insoluble. Occasionally vin. ipecac., mi.—ii.

"Mistura Bismuthi Sedativa."

(1) R. Glycerini Pepsini mii. Bismuthi Carbon. gr. ii. Soda Bicarb. gr. ii. It. Camph. Co. mii—iii. Mucil. Sacchar. Tragacanth (gr. 4) ad 3 <i>i.</i> Sig. : Quart. horis.	Or (2) R. Glycerini Pepsini mii. Soda Bicarb. gr. ii. Liq. Bismuthi et Amm. cit. mii. It. Camph. Co. mii. Aquam ad 3 <i>i.</i> Sig. : Quart. horis.

Besides the above there are fairly good proprietary preparations of bismuth, and many glycerine and pepsine preparations, as Parke Davis', and the ordinary B. P. formula.

"Mistura Ricini."

(1) R. Ol. Ricini mxv. Tr. Rhei mii. Glycerini mx. Tragacanth gr. 4. Aq. Menth. Pip. ad. 3 <i>i.</i> Sig. : Bis. vel. ter in die.

"Constipation."

Or (2) R. Ol. Ricini mx. Podophyllini gr. $\frac{1}{30}$. Glycerini mx. Tragacanth gr. 4. Aq. Anethi ad. 3 <i>i.</i> Sig. : Bis. vel. ter in die.

To either of the foregoing can be added an intestinal antiseptic, as salol.

Both the above bismuth and castor oil mixtures will be found most useful in the later stages of gastric catarrh, as in every single

other affection of the tract, including constipation; also in atrophic cases, rickets, etc. Minute doses of tinct. rhei. being beneficial as stomachic tonic, and having a slightly astringent action.

Avoid the use of astringents and resort only to lime water and pulvis cretæ, or pulv. cretæ. aromat.; the two latter will only in extremely rare instances be necessary, for the reason that it is highly questionable but that astringents as a general rule do more harm than good, as the conditions under treatment do not partake greatly of the adult type of catarrh, being mainly fermentative and vaso-motor in reality, with an appreciable amount of the nervous element. Therefore no formulæ for astringents are given here.

On recovery, when any loss of tone remains, the following are sometimes useful:—

(1) B. Tr. Nucis Vomie m <i>½</i> —i.	Or (2) B. Papain gr. ii.
Acid Hydrochlor dil. miii.	Acid Hydrochlor dil. m iii.
Glycerini Pepsini mii.	Glycerini mxx.
Aq. Chloroformi ad. 5 <i>l</i> .	Aquam ad. 5 <i>l</i> .

Sig.: Tert. horis. cum cito. Sig.: Tert. horis. cum cito.

At onset, stop all milk food and exhibit one of the following:—

(1) Egg and brandy mixture (minus sugar)—One fresh egg, one ounce of boiled warm water, one teaspoonful of good brandy. Sig.: one teaspoonful of the mixture every half hour, if necessary.

Or (2) The white of a fresh egg, 5*l*; one ounce of boiled water; one drop of glycerine of pepsine. *As food*, every two and a half to three hours. (Brandy, mv., si op. sit.) Some carefully selected meat juice preparation may also be used in this way.

(3) Later.—Cream, 3*iss.*; milk sugar, grs. xx., or malt extract, 3*ss.*; whey, 5*l*. *As food*, every three hours. (Brandy, mv.—x., si op. sit.)

(4) Follow still later by a malted milk food.

(5) And, finally, settle down to diluted cow's milk, with extract of malt, or any of the malted, partially pre-digested, foods; having carefully selected one that will suit the particular case.

All milk food shall have, as a matter of course, been rendered, as far as possible, sterile.

ENTERITIS, simple and inflammatory.

Medication, same as in gastric catarrh, also the feeding. Place special stress on salol, gr. $\frac{1}{2}$ —1; salicylate bismuth, grs. ii.—iv.; benzol-naphthol, grs. ii.—iv.; and to liver stimulants (*not purgative*), such as calomel, gr. $\frac{1}{6}$ — $\frac{1}{3}$; hydrarg. cret., gr. $\frac{1}{2}$ —ii.; liq. podophyllin (Hockin), m $\frac{1}{2}$ —i.; and castor oil as a fixed routine.

In the more chronic forms resort to "Mistura Bismuthi" and "Mistura Ricini" with any of the above antiseptics.

Remember to get the full trophic benefits from pepsine.

INFANTILE CHOLERA. (*See text.*)

ULCERATION, high up and low down in bowel, and in dysentery (*See* carefully the full treatment in text.)

Medicate as in gastric catarrh and enteritis, and in dysentery and colic and rectal ulceration resort to boracic acid irrigation—for which refer to text, and be extremely careful to use opium as an aid to cure, and not as a means to assist retention and further septic poisoning.

SYPHILIS, must of course be treated "secundum artem."

TUBERCULAR ULCERATION OF BOWEL.

The therapeutics of this affection can at best be only prophylactic, and its treatment ought, paradoxically, to begin at the sources of milk supply, that is, before the patient contracts the disease. When established, medicate and feed as for gastric catarrh, with special reference to the use of salol and salicylate of bismuth, and benzosol, which is recommended as decomposing, *in situ*, into guaiacol and benzoic acid.

TYPHOID conditions of the bowel, for the purposes of this treatise, are purely matters of strict intestinal antisepsis. Salol, salicylate of bismuth, carbolic acid, stimulants, and avoiding poisonous waste products of beef tea; also see text-books on typhoid fever.

INFANTILE ATROPHY AND RICKETS.

As these conditions more often than not call for greater trouble than any other chronic complaint of infantile life, certain points as to classification of foods will not be out of place here. These foods comprise general foods and special foods, as malt compounds, chemical foods, and preparations of cod liver oil.

“The best food for an infant is its mother’s milk when possible.”

GENERAL FOODS—When hand fed.

TABLE OF FEEDING.

Age.	Time.	Amount of Food.	Proportions (Roughly). Cow-milk. Water.	
First week.	Every 2 hours.	One ounce.	Whey & cream. 3 <i>iii.</i>	3 <i>iii.</i>
Second week to 1 month.	Every 2 <i>½</i> hours.	Two ounces.	One-third. Milk.	Two-thirds.
1 month to 3 months.	Every 3 hours.	2 <i>½</i> to 4 ounces.	Half. Milk.	Half.
3 months to 6 months.	Every 3 hours.	5 to 6 ounces.	Two-thirds. Milk.	One-third.
6 months to 1 year.	Every 3 hours.	6 to 8 ounces.	Three-quarters to pure milk.	One-quarter.

The above table refers to conditions of health; in conditions of disease the amount given at a single meal should be rather less. Few infants will be found to adhere regularly to the correct times of feeding. Give cream, 3*iss.*, till end of second month, then 3*ii.*, and add 3*ss.* for every month, till 3*iv.* in the seventh month; and keep at that. Give of milk-sugar, 3*ss.*, till one month old. Where possible, after the first month, substitute active extract of malt for

milk-sugar when feeding with cow's milk, for reasons explained in the text. Cream is not so necessary when using malt extract.

Sterilize all milk before using, and where this cannot be done, then direct every single meal to be boiled before using; only omitting to add the malt extract till *after* the milk has cooled down, and immediately before feeding.

After the birth of an infant and (if breast-fed) till the mother has milk to feed the child, give food as below:—

(1) B. Cream 3iss.	Or (2) B. Cream 3iss.
Milk sugar 3ss.	White of a fresh egg 3i.-ii.
Whey 3ii.	Milk-sugar 3ss.
Boiled water 3iii.	Warm (boiled) water 3iv.-v.
Every two hours.	(Glycerini pepsini mi. si. op. sit.)
Temp., 101°-102° F.	Every two hours.
(Warm the bottle.)	Temp., 101°-102° F.

HAND FED.

From the second week till one month old (approximately):—

B. Cream 3iss.	Temp., 102°-103° F.
Milk (boiled) 3v. ...	1½ teaspoonfuls.
Milk sugar 3iss. ...	5 teaspoonfuls.
Boiled water 3i. 3i. ...	½ teaspoonful.
Every two and a half hours.	9 teaspoonfuls.

From one month old till three months old (approximately):—

B. Cream 3iss.	Temp., 102°-103° F.
Milk (boiled) 3i.-3iss. ...	1½ teaspoonful.
Malt extract 3i. ...	2-3 tablespoonfuls.
Boiled water 3iss.-3ii. ...	Small teaspoonful.
Every three hours.	3-4 tablespoonfuls.

From three months old till six months old (approximately):—

B. Cream 3ii. ...	Temp., 102°-103° F.
Milk (boiled) 3iiss.-3iiss. ...	2 teaspoonfuls.
Malt extract 3i. ...	5-9 tablespoonfuls.
Boiled water 3ii. ...	1 teaspoonful.
Every three hours.	4 tablespoonfuls.

From seven months old to one year (approximately):—

B. Cream 3iv. ...	Temp., 102°-103° F.
Milk (boiled) 3iiss.-3iiss. ...	4 teaspoonfuls.
Malt extract 3i. ...	8-16 tablespoonfuls.
Boiled water 3ii.-3o. ...	1 teaspoonful.
Every three hours.	4-0 tablespoonfuls.

After one year of age, a child can usually begin to take one or other of the partially predigested farinaceous malted foods ; and at or about fifteen months, some meat food in the form of $\frac{1}{2}$ i.— $\frac{1}{2}$ ii. of fresh meat extract once a day, and so on, according to circumstances and indication.

Should a child taking the foregoing dietary show signs of deficiency of bone-formation or anaemia, or is backward with his teeth, then the following addition will be of service:—Instead of giving one teaspoonful of malt extract in each feed, add to the food half a teaspoonful of malt extract, together with an equal quantity of the Syrup Ferri Phosphatis, or use one teaspoonful of a phosphated (ferrated) extract of malt. Remembering that the Syrup Ferri Phosphatis is an acid preparation, it will be better to administer it separately, say $\frac{1}{2}$ iss.— $\frac{1}{2}$ i., three times a day.

As regards the teeth, the question seriously arises as to whether, in cases where families are reputed to have constitutionally bad teeth (brittle and liable to decay), special feeding of set purpose should not be deliberately entered upon during infancy and early childhood in order to promote sounder dental issue in the permanent teeth as to dentine and the amount, also the quality, quantity, and regularity of the enamel. This is by no means an insignificant item in correct infant feeding, bearing as it does on the alimentation of the whole after life.

If more convenient during the last six months of the first year, one or other of the more completely malted and predigested foods can be used, care being taken to watch the effect, and make a change from one to the other if necessary, or add some ferruginous preparation if conditions call for it.

Pepsine solutions, as the glycerine of pepsine, should always be at hand, as one or two drops often quickly sets any slight derangement right.

ARTIFICIAL FOODS.

On account of the uncertainty which sometimes exists as to the use of commercial artificial foods, and for the sake of some slight

amount of exactitude in their use—both in conditions of health, and in conditions of disease which permit of their use—an attempt is here made to approximately classify them according to their physical properties and gastronomic effects.

It must be clearly understood that no special preference can possibly be shown for any one preparation over another, as they do not all suit the same child, neither must they be considered as in any way specifics or cures for diarrhoea ; for infants in some cases, whilst partaking of one or other of them, have been attacked by that complaint ; so that at the most, they must only be regarded, each one, as a means to an end only ; thus do we avoid falling into error and consequent disappointment, with, perhaps, more or less unjust prejudice against this or that special preparation. Further, that as this is not an encyclopædic directory of these preparations, only a few types of the more commonly used foods will be taken as examples.

Artificial foods may for practical purposes be roughly divided into four groups :—

Group I.—“Foods of slight resistance to infantile digestion,” or such as have all, or nearly all their ingredients so altered, as regards physical properties and existing proportions, as to be chiefly applicable to early infantile life. Of these the following are fair examples :—

(a) Humanised milk, a preparation of milk, whey, cream and milk sugar, in which the proportion of casein has been brought down to (should be slightly *below*) that in human milk by dilution with whey, and cream and milk-sugar added to raise the proportions to that of human milk. These preparations should as far as possible be recently prepared and sterilised.

(b) Powdered humanised milk, in which the casein exists in the form of powder, and has been reduced to the proportions of human milk, with added cream and milk sugar, prepared by the addition of boiling water.

(c) Preparations of milk with a carbohydrate, in which the casein has been greatly modified by the diastasic action of malt-ferment on both the milk and the carbohydrate, the latter of which is completely converted and both reduced to a dry powder in vacuo.

Group II.—“Foods of rest.”—Totally predigested foods, or foods which offer little or no resistance to infantile digestion, chiefly useful during irritable and deranged conditions of the alimentary canal: Of these the following are fair examples:—Pancreatised preparations of fresh cow’s milk in various proportions and quantities; various proportions of fresh cow’s milk, and preparations of whey and cream, both with active malt extracts, etc. It is necessary to note that it is taken for granted that medical attention is duly paid to the correction of septic and fermentative processes occurring in the canal, as otherwise, there is no food yet devised by man which will not be found to disagree:—

(a) Pancreatised milk foods, prepared by acting on milk, etc., in various proportions and quantities, $\frac{1}{2}$ to $\frac{3}{4}$ of a pint diluted with boiled water, by various ferments, as “Zymine”; which is a compound ferment, grs. v., along with carbonate of soda, grs. xv.—xx., for various lengths of time, at or about the temperature that the immersed finger can just comfortably stand. (See usually furnished directions, and text-books.)

(b) Totally predigested, malted carbohydrates, in combination with malted casein. Fresh diluted cow’s milk, predigested or not, can be added if desired.

(c) Preparations of powdered humanised milk, and totally predigested, malted carbohydrate.

Care should be exercised in the choice of food and mode of preparation according to a particular case and surrounding circumstances, as the means, intelligence of attendants, and their general cleanliness, otherwise pancreatisation only opens up new channels of septic infection.

Bear in mind the need for rigid sterilisation or previous boiling before feeding.

Group III.—“ Foods of mild functional stimulation ; ” partially predigested foods, leaving a certain amount of work to be done by the infantile digestion, thereby keeping it in “ proper tone,” yet, such as are of high nutritive value, possessing albuminoids, natural or added, as that of cereals (germ and cortex), or casein of milk, or egg albumin, carbohydrates, fats, and salts (phosphates), etc. Suitable for convalescence and conditions of comparative health in later infantile life. And certain other foods, described under Group I. as humanised milk, fresh cow’s milk with active malt extract, etc., etc. (Sterilize or boil all milk before use.)

(a) Certain composite, carbohydrate foods, partially predigested and malted, to which fresh cow’s milk must be added.

(b) Partially malted, predigested foods, to which cow’s milk must be added.

(c) Preparations of carbohydrate, said to contain the active ferment of the pancreas, to be prepared after a certain manner, and to which fresh cow’s milk must be added.

(d) Foods, consisting of desiccated milk, egg albumin, and wheat flour, all sterilized (*in vacuo*), to which fresh cream may be added, and also active extract of malt if desired.

(e) Fresh cow’s milk and active malt extract (as described in text), which can be fortified by the addition of phosphated ferrated extract of malt, such as a Pyrophosphated Extract of Malt.

From the foregoing three groups it ought to be possible, exercising due care and thought, to make a selection of a food which should suit most cases, and effecting a change, when necessary, from advancing age and increasing digestive power, or where the first or second selection does not happen to suit a particular case.

A new ferment of farinaceous foods, Taka-Diastase (Prof. Takamine), has been recently introduced by Messrs. Parke, Davis & Co. It is of Japanese origin, and is said to be a fungoid growth, analogous to, though not identical with, ergot of rye (*Eurotium Oryzæ*). It is alleged to be very powerful in its action on

starch, converting it rapidly into dextrine and maltose. It must be used in very small quantity, gr. $\frac{1}{4}$ — $\frac{1}{2}$ for children, as in one or two cases of adults doses of 3 grs. were found to be rather strong. Further and more extended experience of it will possibly prove useful and instructive.

Condensed tinned milk preparations are duly borne in mind, but have a great drawback, in that, as they tend to last a certain time, their last state is more often than not, generally, worse than their first, that is, viewed from an aseptic standpoint.

Group IV.—“Roborant Foods,” or foods of extraordinary nutritive index; and where it is desirable to reinforce any of the members of the three foregoing groups or to bring about “systemic tone” and tissue increase, when rendered necessary, as in conditions of atrophy, rickets, struma, anaemia, etc. Examples of these are: cod liver oil and emulsions and combinations of cod liver oil, extract of malt and combinations of the same, syrup of the phosphate of iron, lime and magnesia, preparations of the hypophosphites of sodium and calcium, etc.; and red sanguous matter, as beef extract or fresh raw meat pulp. Small doses of arsenic may be here mentioned in the above respects, such as minute doses of the arseniate of iron; arsenic being said to somewhat retard tissue waste and promote accumulation. Arsenic, however, must not be resorted to as a routine, and only after other methods have failed, though in some few cases it does good. Bearing in mind the previous text regarding the necessity for attending to the digestive organs, their functions and secretions, we may now briefly consider certain of the foregoing.

COD LIVER OIL.

“Emulsion of Cod Liver Oil.”	“Emulsion of Cod Liver Oil with Hypophosphites.”
(1) R. Ol. Morrhuae mx.	(2) R. Sodii Hypophos gr. $\frac{1}{2}$.
Liq. Calcis. Sacchar. mii.	Calcii Hypophos gr. $\frac{1}{2}$.
Glycerini mv.	Ol. Morrhuae mx.
Aq. Tragacanth (4 gr.) ad 5 <i>l</i> .	Glycerini mv.
Sig. Ter in die.	Aq. Tragacanth (gr. 4) ad 5 <i>l</i> .
	Sig. : Ter in die.

The above are useful formulæ for preparing an emulsion when

desirable. Certain ready-made emulsions of the oil can be obtained on the market of more or less individual merit. Emulsions of Cod Liver Oil in malt extract are for various reasons best obtained ready made, and are usually to be obtained from any firm dealing in malt extracts.

MALT EXTRACT.

Many preparations of this food appear in the market, and the essential points are that it shall be fairly liquid, be active in converting a certain proportion of starch, should contain the natural salts of the particular cereal used, and should be absolutely free from any tendency to granulate. It has been found in actual practice that it is more conveniently handled and with less mess, waste and stickiness, when put up in wide-mouthed glass honey jars, closed with a screw metal cap, washered with cork to keep the malt from contact with the metal. The glass had best not be tinted the usual brown, as this tends to obscure the condition of the malt (in spite of the usual excuse of protection from light). Practically speaking there seems to be no objection to put up malt extract as above, and this method is well appreciated by the users of the commodity. Saving of trouble is a great factor (in the lay opinion) where infants are concerned.

There appears to be a vast field waiting to be exploited by those who would put the profession and public on the way to obtain an active, reliable, plain extract of malt, sufficiently cheap, to become an article of ordinary everyday use in infant feeding, and within the reach of all purses.

Malt extract can be most advantageously given in ordinary combination with the syrup of phosphates (iron, lime, and magnesia), or any other suitable preparation, either of them in equal quantities (aa. 3ss.).

BEEF EXTRACT.

Beef extract is seldom necessary or desirable for children under fifteen months old. The following method of preparing a highly

The use of one or other procedure must be entirely a matter of circumstance or necessity.

It is as well to bear in mind that the resultant myosin curd, after heating the red filtered solution, is frequently thrown away by the lay attendants under the impression that it is "meat fibre," and will be injurious, or is not desirable. Attention to this matter and warning against this mistake will prevent annoyance.

CLOTHING OF INFANTS.

As mentioned in text, the clothing and binders tend to ride up and unnecessarily expose the trunk of an infant. This is often a great nuisance and detriment to a child when in indifferent health; indeed may be said to be so at all times. An excellent, cheap garment for preventing this can be obtained; it is known as a child's "Mavette," and not only answers this requirement, but is also an aid when such procedures as poulticing the chest be desired.

There are many other little matters connected with the proper care of infants in health and disease, requiring an encyclopædia, which are for obvious reasons not gone into here, and are confidently and safely left to the skill and individuality of the reader.

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